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Aims and Scope

IBU Journal of Science and Technology (IBUJST) is a refereed international journal and devoted to the rapid publication of original and significant research in the fundamental theory, practice and application of engineering, science and technology. IBU Journal of Science and Technology will publish papers in science, technology, engineering and application in the areas of, but not limited to: agricultural engineering, biomedical engineering, chemical engineering, civil engineering, computer engineering, electrical engineering, genetics & bioengineering, industrial engineering, mechanical engineering, chemistry, physics, and mathematics. As an international science and technology journal with interdisciplinary feature, it will set a ground to bring science and engineering communities across disciplines identified above with a view for sharing information and debate. The journal publishes refereed articles and technical research notes that build on theory and contemporary scientific knowledge. Articles submitted to IBUJST will be peer-reviewed and expected to report previously unpublished scientific work. Submitted manuscripts should follow journal guidelines and should not be under consideration elsewhere.

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EDITORIAL

IBU Journal of Science and Technology

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Welcome to the second issue of the Journal of Science and Technology. The beginning of 2014 comes with enthusiasm and great motivation for initiating an academic, peer-reviewed journal dedicated to publishing scholarly work in information technology and related scientific areas. In this journal, we plan to publish conceptual and empirical papers that take an interdisciplinary perspective in the areas of agricultural , biomedical, chemical, civil, computer, electrical, genetic, industrial, mechanical, naval, nuclear, software engineering. As scientific inquiry advances, researchers in different scientific areas benefit from theories and concepts in other areas, which can bring a broader perspective to their explanations. As such, our journal will attempt to bring academics from various backgrounds to advance theories and offer solutions for society's problems.

Assesment of Coal Import Prices and Import Years in Turkey

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Abstract: Statistical analysis techniques are one of the important analysis techniques for the energy issues. In this paper, coal import prices ($) and coal import years (2000-2010) in Turkey are assessed by using the statistical analysis techniques including cluster analysis and block diagram. Through the results from the cluster analysis, it was determined that three different groups of coal import years and two different groups of coal import prices. After, the results of cluster analysis supported the block diagram. Finally, this study shows that the beneficial to statistical analysis techniques such as cluster analysis and block diagram for grouping in the coal import prices ($) and coal import years (2000-2010).

Keywords: energy; coal, import prices, cluster analysis, block diagram, turkey.

1. INTRODUCTION

Energy is a significant factor for economic development and social prosperity of countries. Modern society would have not been possible without energy (Capik, Yilmaz & Cavusoglu; 2012).

Coal is the altered remains of prehistoric vegetation that had originally accumulated in swamps and peat bogs. The most significant uses of coal are in electricity generation, steel production, cement manufacturing and other industrial processes, and as a liquid fuel (Jorjani, Mesroghli & Chelgani, 2008; Yerel & Ankara, 2011).
Turkey is situated at the meeting point of three continents (Asia, Europe and Africa) and stand as a bridge between Asia and Europe. The country is located in

southeastern Europe and southwestern Asia. Its size is 779,452 km^2. Turkey's population was about 73 million in 2007 (DIE, 2007). Because of social and economic development of the country, the demand for energy is growing rapidly. The main indigenous energy resources are hydro, mainly in the eastern part of the country, and lignite (MEF, 2007; (Toklu, Guney, Isik, Comakli & Kaygusuz, 2010).

Turkish coal and lignite are largely inappropriate for the purpose of sustainable development as their usage is cost ineffective and responsible for air pollution in urban centers during the 1970s and 1980s. This is because Turkish lignite has low calorific value and high sulfur, dust and ash content whereas Turkish hard coal is low grade (Yuksel, 2010; Yarbay, Guler & Yaman, 2011).

Turkey imports significant amounts of hard coal, mainly from Australia, The United States, South Africa and Russia (Balat, 2006; Yerel & Ersen, 2012). In this article coal import prices and coal import years assessed by using the statistical analysis techniques such as cluster analysis and block diagram.

2. MATERIALS AND METHODS

2.1. Cluster analysis

Cluster analysis is a multivariate technique, whose primary purpose is to classify the objects of the system into categories or clusters based on their similarities, and the objective is to find an optimal grouping for which the observations or objects within each cluster are similar, but the clusters are dissimilar to each other. Hierarchical clustering is the most common approach in which clusters are formed sequentially. The most similar objects are first grouped, and these initial groups are merged according to their similarities. Eventually as the similarity decreases all subgroups are merged into a single cluster.

Cluster analysis was applied to surface water quality data using a single linkage method. In the single linkage method, the distances or similarities between two clusters A and B are defined as the minimum distance between a point in A and a point in B:

$D(A,B)=\min\{d(x_i+x_j)$, for x_i in A and x_j in B$\}$ (1)

where $d(x_i+x_j)$ is the Euclidean distance (Johnson and Wichern, 2002; Alvin, 2002; Yerel, 2010).

2.2. Database

The dataset are composed, four different type coal import prices ($) such as briquettes, solid fuel from coal (A), lignite and turba from coal and retards (B), oil and other product from coal (C) and charcoal (D). The dataset is obtained from 2000 - 2010.

The dataset is assessed using the statistical analysis techniques such as cluster analysis and block diagram. All statistical computation is made using statistical software.

3. RESULTS AND DISCUSSION

In this paper, cluster analysis is used to determine similarity groups among the coal import prices ($) and coal import years (2000-2010). The dataset were used to graphed dendrogram (Fig. 1-2).

Fig. 1 show that the coal import years are composed three different groups. Group 1 is formed 2000, 2006, 2005 and 2007; group 2 is composed 2001, 2002, 2003 and 2004 and group 3 is formed 2008, 2009 and 2010.

Fig. 2 presents that the coal import prices are formed two different type prices in Turkey. Group 1 is formed B, C and D; group 2 is composed A.

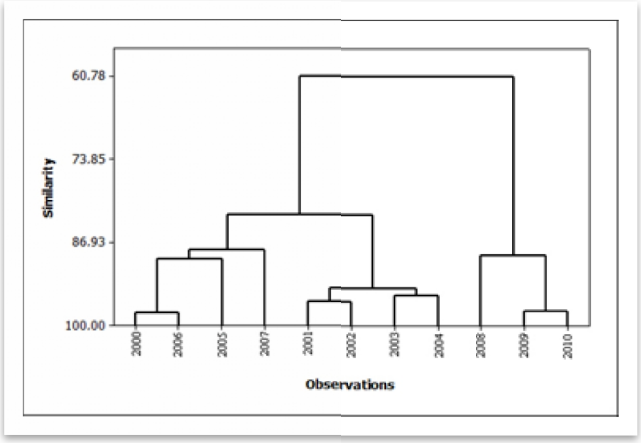

Figure 1. Dendrogram of the coal import years

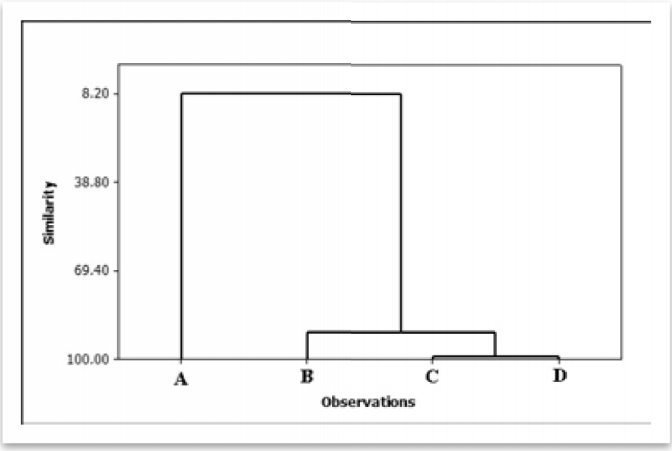

Figure 2. Dendrogram of the coal import prices

The coal import years and coal import prices in Turkey were compared in Fig. 3-4. The Fig. 3 presented that the three different groups are composed according to years. Group 1 is composed 2000, 2006, 2005 and 2007; group 2 is formed 2001, 2002, 2003 and 2004 and group 3 is generated 2008, 2009 and 2010. The block diagrams show that the coal import prices are increased last three years.

The Fig. 4 shows that the two different groups are composed according to coal import prices. Group 1 is generated B, C and D; group 2 is composed A.

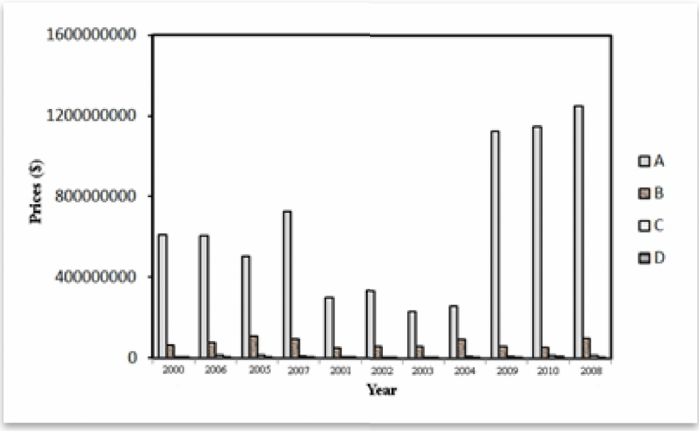

Figure 3. Year versus prices ($)

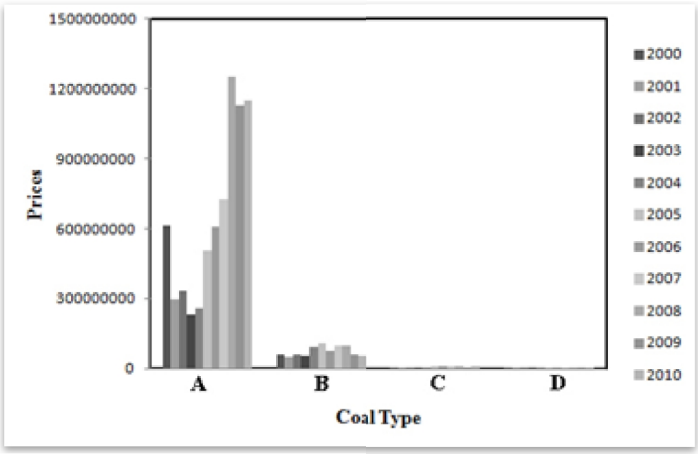

Figure 4. Coal type versus prices

4. CONCLUSION

In this paper, the coal import prices and the coal import years in Turkey were investigated statistical analysis techniques. Cluster analysis was applied to determine similarity groups among the coal import prices ($) and the coal import years (2000-2010). Coal import prices are determined two different groups and coal import years are determined three different groups. After, the coal import prices and the coal import years were using the constructed block diagram. The results of cluster analysis are back up the block diagram. Finally, the analysis presents that the coal import prices are increased last three years.

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MQL Machining – Oil on Water Droplet System

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Abstract: Flood and through-tool delivering of cutting fluids have been widely used for the machining operations. The use of a large amount of cutting fluid can impact the environment and increase manufacturing costs, and possibly lead to ground contamination, excess energy consumption, the need for wet chip disposal and potential health and safety issues. Minimum Quantity Lubrication (MQL) machining involves the application of a minute amount of oil-based lubricant to the machining process in an attempt to replace the conventional flood coolant system. This paper presents a classification of MQL methods, discussing their advantages and drawback. Also, the results of measurements of cutting forces and surface roughness when machining one type of aluminum bronze using MQL, are presented. As a medium for cooling and lubricating a system of oil-on-water was used. The results show that the cutting force of less than 16%, and also parameters of surface roughness, compared to machining without the use of coolant and lubricants.

Keywords: mql machining, oil-on-water droplet, aluminium bronze, cutting forces, surface roughness.

1. INTRODUCTION

The basic functions of a metal working (cutting) fluid are to provide cooling and lubrication and thus reducing the severity of the contact processes at the cutting tool–chip and cutting tool–workpiece interfaces. A metal working fluid may significantly affect the tribological conditions at these interfaces by changing the contact temperature, normal and shear stresses and their distributions along the

interfaces, the type and/or mechanism of tool wear, machined surface integrity and machining residual stresses induced in the machined parts, etc. (Nourredine & Shaikh 2012; Asthakov 2006). In some applications, it is expected that metal working fluid should also provide secondary service actions, for example, washing of the machined part or chip transportation in deep-hole drilling, in which the metal working fluid transports the chip over significant distances (Braga et al 2002).

Although the significance of metal working fluids in machining is widely recognised, cooling lubricants are often regarded as supporting media that are necessary but not important. In many cases, the design or selection of the metal working fluid supply system is based on the assumption that, the greater the amount of lubricant used, the better the support for the cutting process. As a result, the machining zone is often flooded with metal working fluid without taking into account the requirements and specifics of an operation (Ashtakov 2009).

According to the manufacturing statistics shown in Fig. 1. the total cost for acquiring, maintaining and disposing of coolants represents between 8% to 20% (approximatelly 15%) of total production cost depending on the workpiece, the production structure and the production location (Weinert et al 2004). In contrast, tooling cost is within single digits (usually about 4%). Cost, as well as health and environmental issues, mandate manufacturing enterprises to drastically reduce coolant consumption and, if possible, eliminate it altogether. As a result, these trends tend to two more economically and environmentally friendly conceptions of machining, termed, dry machining and MQL machining or near-dry machining.

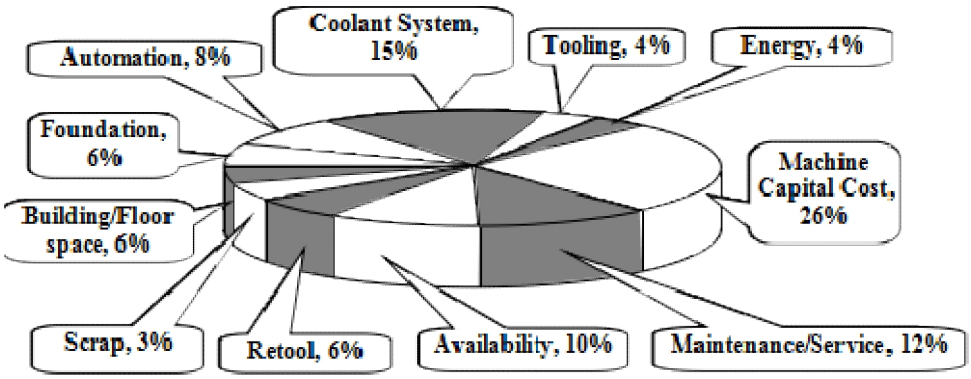

Figure 1. Distribution of manufacturing costs for wet machining

Ecological and health aspects of metalworking fluids' manufacture, use and disposal have become very important due to new stricter legislation, notably in Europe (Ashtakov 2009). In the European Union, metal working fluids and lubricants are included in the voluntary Eco-label initiative, which is dedicated to stimulating the supply and demand of products with reduced environmental impact. The number of country specific standards for environmental labeling of metalworking fluids and other chemicals is ever increasing, including Blue Angel certification in Germany, the SS 155434 standard in Sweden, and VAMIL regulation in The Netherlands. In the UK, the Health and Safety Executive is developing more stringent mandatory workplace exposure limits to airborne mist from metalworking fluids.

It is estimated that metal working fluid consumption is more than 100 million gallons per year in the USA (Feng & Hattori 2000). A typical large automobile metal processing facility utilizes more than 2.28 million litres of metal working fluid concentrates per year and more than 1.14 million litres of straight oil per year. In Germany, coolant consumption is about 75.500 tons a year (Klocke & Eisenblaetter 1997). In Japan, metal working fluid consumption is 100,000 kilolitres of water-immiscible (disposal cost ¥35–50 per litre), 50,000 kilolitres of water-soluble coolant without chlorine (disposal cost ¥300 per litre) and 10,000 kilolitres of water-soluble coolant with chlorine (disposal cost ¥2250 per litre) (Feng & Hattori 2000).

According to the National Institute for Occupational Safety and Health (NIOSH), over 1 million workers in the USA are exposed to metal working fluids (Ashtakov 2009). Machinists, machinery mechanics, metalworkers and other machine operators and setters have the greatest contact with these fluids. However, workers performing assembly operations can also be exposed if metal working fluids remain on the machined product. Workers other than machinists may also be exposed to metal working fluid mists if ventilation systems are poorly designed or inadequate. Workers may be exposed by skin contact, inhaling (breathing in), or ingesting (swallowing) particles, mists and aerosols.

There are several principal ways to reduce ecological, economical and health impacts of metal working fluids:

- Balanced selection of metal working fluids,
- Proper application of metal working fluids,

- Meticulous management of metal working fluids, and
- Gradual reduction of metal working fluids usage by increasing the use of MQL machining (or near-dry) and dry machining. At present, many efforts are being undertaken to develop advanced machining processes using less or no metal working fluids.

2. MQL MACHINING

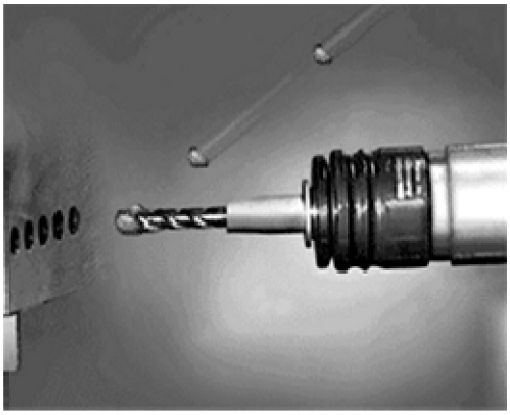

Figure 2. Idealized image of MQL machining

Minimal quantity lubrication (MQL) machining, also known as near-dry machining (NDM), supplies very small quantities of lubricant to the machining zone. It was developed as an alternative to flood and internal high-pressure coolant supply to reduce metal working fluids consumption.

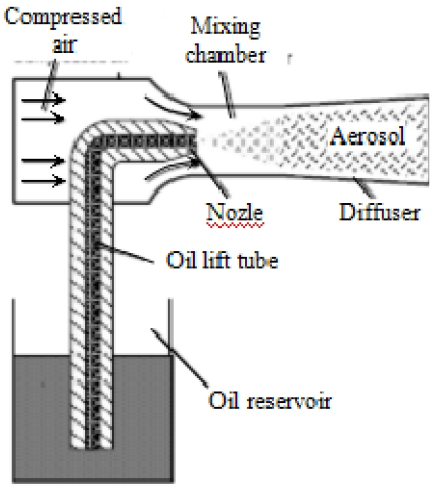

Figure 3. Model of a simple atomizer

In MQL machining, the cooling media is supplied as a mixture of air and an oil in the form of an aerosol (often referred to as the mist). An aerosol is a gaseous suspension (hanging) into air of solid or liquid particles. In MQL machining, aerosols are oil droplets dispersed in a jet of air. An idealized picture of MQL machining is shown in Fig. 2: small oil droplets carried by the air fly directly to the tool working zone, providing the needed cooling and lubricating actions (note: Scale of oil droplet size and drill's dimension are different).

Aerosols are generated using a process called atomization, which is the conversion of bulk liquid into a spray or mist (i.e., collection of tiny droplets), often by passing the liquid through a nozzle. An atomizer is an atomization apparatus; carburetors, airbrushes, misters, and spray bottles are only a few examples of the atomizers used ubiquitously. Despite the name, it does not usually imply that the particles are reduced to atomic sizes. Rather, droplets of 1–5 μm are generated. Because metal working fluid cannot be seen in the working zone, and because the chips look and feel dry, this application of minimum-quantity lubricant is called near-dry machining.

An atomizer is an ejector in which the energy of compressed gas, usually air taken from the plant supply, is used to atomize oil. Oil is then conveyed by the air in a low-pressure distribution system to the machining zone. The principle of the atomizer is shown in Fig. 3. As the compressed air flows through the Venturi path, the narrow throat around the discharge nozzle creates a Venturi effect in the mixing chamber, i.e., a zone where the static pressure is below the atmospheric pressure (often referred to as a partial vacuum). This partial vacuum draws the oil up from the oil reservoir where the oil is maintained under a constant hydraulic head. The air rushing through the mixing chamber atomizes the oil stream into an aerosol of micron-sized particles.

2.1. Classification of MQL machining by aerosol supply

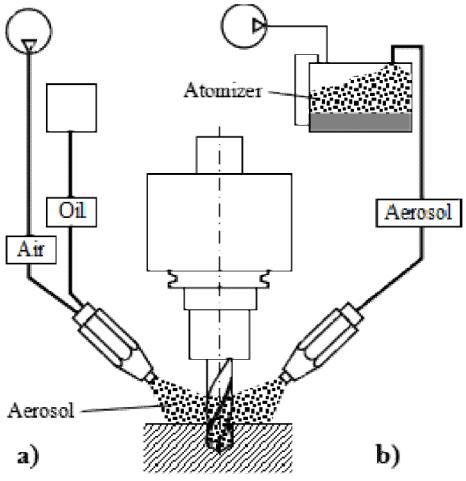

Figure 4. The principle of MQL with external aerosol supply

Both, in literature and in practice, there is no accepted classifications of MQL machining so it is very difficult for a practical engineer or plant manager to make the proper choice about the regimes of MQL machining and equipment needed. The first level of MQL classification includes a way by which aerosol is supplied into the machining zone: a) MQL with external aerosol supply (the aerosol is supplied by an external nozzle placed in the machine similar to a nozzle for flood metal working fluid supply), and b) MQL with internal

(through-tool) aerosol supply (the aerosol is supplied through the tool similar to the high-pressure method of internal metal working fluids supply).
There are two options in MQL with external aerosol supply, which are shown in Fig. 4:

- MQL with an ejector nozzle. The oil and the compressed air are supplied to the ejector nozzle and the aerosol is formed just after the nozzle, as shown in Fig.4.a.

- MQL with a conventional nozzle. The aerosol is prepared in an external atomizer and then supplied to a conventional nozzle, as shown in Fig.4.b. The nozzle deign is similar to that used in flood MWF supply.

As the name implies, MQL with internal aerosol supply includes internal passages for aerosol supply. There are two options:

- MQL with an external atomizer. The aerosol is prepared in an external atomizer and than supplied trough the spindle and internal channels made in tool.

- MQL with an internal atomizer located in the spindle of the machine. This is a more attractive concept: to mix the air and oil as close as possible to the tool in a well-designed mixing chamber.

2.2. Classification of MQL machining by aerosol composition

Generally speaking, there are two groups of MQL machining with respect of aerosol composition. First group represents the aerosol as an air–oil mixture. The discharge of the oil in this mixture is selected to be in the range 30–600 ml/h depending upon the design of the MQL system, the nature of the machining operation, the work material and many other factors. Second group represents so called advanced MQL system uses aerosol that includes not only oil but also some other components. There are two examples of advanced MQL systems: oil on water droplet and advanced minimum quantity cooling lubrication machining (MQCL machining).
Oil on water droplet MQL includes the supply of water droplets covered with a thin oil film (Yoshimura et al 2006; Itoigawa et al 2006). As claimed by its authors, this method possesses both great cooling and lubricating abilities. The former is due to water properties (high specific heat capacity, density and thermal conductivity compared to air) and its evaporation. The latter is due to the specific droplet configuration.

MQL based on the concept of oil on water droplet is shown in Fig. 5, which shows an ideal oil on water droplet moving towards a hot surface. When the droplet reaches the tool or hot workpiece surface, the lubricant oil spreads over the surface in advance of water spreading. The water droplets are expected to perform three tasks: carrying the lubricant, spreading the lubricant effectively over the surface due to inertia and cooling the surface due to its high specific heat and evaporation. To make this concept practical, i.e., to generate oil on water droplets, a specially designed discharge nozzle is needed.

Results of experimental studies are presented in the following section of this paper is related specifically to the use of this MQL system.

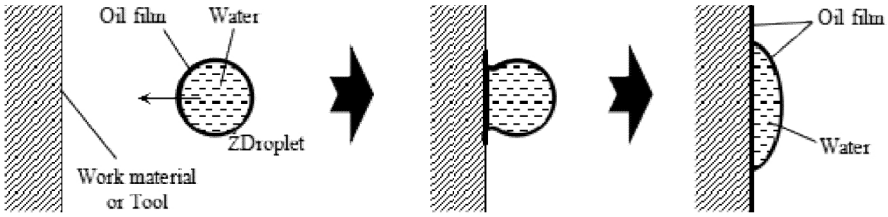

Figure 5. The concept of the oil on water MQL machining

3. EXPERIMENTAL WORK

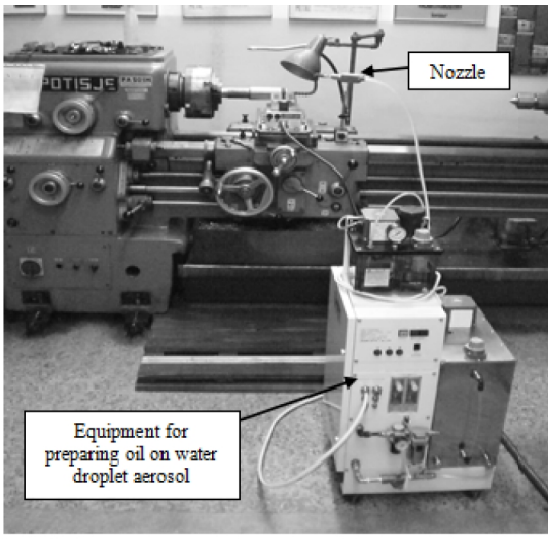

Figure 6. Experimental setup

During the last ten years, a lot of research studies in area of MQL machining has been performed. Much of the results of various studies available in the periodical literature. For example, Tai et al, 2011, reported on lubricant properties in MQL machining, than Kalita & Malshe, 2010, reported on nano lubricant in advanced MQL machining, and Hiroshi, 2004, made study on oil on water drop cutting fluid.

The experiments, which results are presented in this paper were conduc-ted at the Laboratory for metal cutting and machine tools (LORAM) at Faculty of Mechanical Engineering University of Zenica. Machining tests were carried out on a lathe. Workpiece material is a kind of aluminum bronze tags Cu85.5Al10Fe2.5Mn2, hardness of 150 HB. Machining tests were carried out by turning in two way: without the use of metal working fluid, and by use of MQL machining (oil on water droplet). Turning conditions were: cutting speed v=130 mpmin, depth of cut d=1.5 mm, and feed f=0.16 mmprev. Experimental setup is shown in Fig. 6. MQL machining conditions were as follows: the amount of oil 50 mlph, the amount of water 50 mlph, and the pressure of compressed air p=2 bar. Vegetable (biodegadable) rapeseed oil is used. By using appropriate measuring equipment, cutting forces are measured (dynamometer KISTLER 5070) and also surface roughness parameters are measured (Perthometer M1). Table 1 shows the results of measuring cutting forces and surface roughness parameters. Corresponding graphical interpretation of these results are given in Fig. 7 and Fig. 8.

Table 1. Results of measuring cutting forces and surface roughness parameters

Machining operation	Cutting forces, N			Surface roughness parameter, mm	
	Fx	Fy	Fz	Ra	Rmax
Machining without the use of metal working fluid	262	227	455	8.86	42.90
MQL machining (oil on water droplet)	243	213	436	8.54	36.6

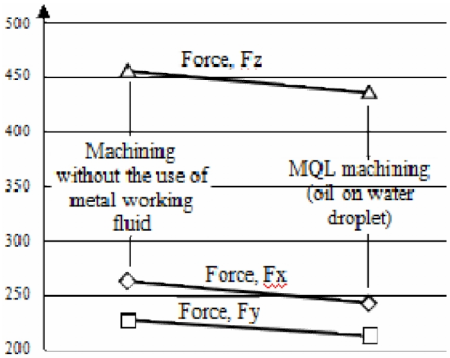

Figure 7. Graphical interpretation of cutting forces measering results

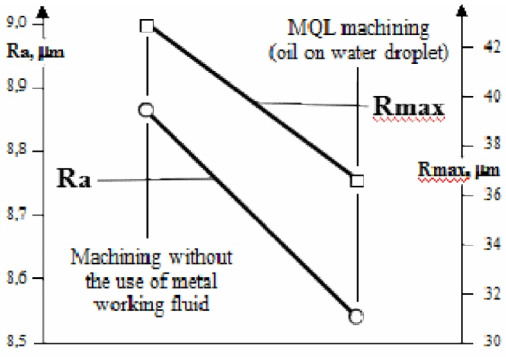

Figure 8. Graphical interpretation of surface roughness parameters measering results

4. CONCLUSION

When analyzing the results of measuring the cutting force can be drawn the following conclusions. In MQL machining are measured less cutting force and that all three components of the force. When calculating the total cutting forces based on measured values of the components, the machining without the use of coolants and lubricants gain force Ft = 572 N, and the oil on water droplet MQL machining gain force Fr = 485 N. The obvious difference is, as much as 16%.
Also, when considering the measured values of the surface roughness parameters, it is seen that the lower values measured in MQL machining. Therefore, a better quality of the machined surface is achieved by the MQL machining.
Finally, as a general conclusion, it can be conclude the following:

- Application of MQL machining is much more acceptable from an environmental standpoint because the processing used vegetable oil that does not pollute the environment,
- The amount of oil used is many times smaller than for the classical treatment with heavy use of coolants and lubricants,
- Less cutting force by 16% for MQL processing actually mean less power consumption which is very important in terms of energy savings (sustainability), and

- Better quality of the machined surface is achieved by the MQL machining in comparison with machining without metal working fluid.

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Farming of Pangasius for Sustainable Aquaculture

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Abstract: Fisheries are the fastest growing food production system in the world. Global production has grown considerably in aquaculture and this disposition is being expected to increase. In this regard, a new way of species search has commenced in aquaculture. Aquaculture of Pangasius sp. has a significant place in this search among sustainable tropical species.

Among other cultured species pangasius is the 4th most commonly cultured species in the world after salmon, shrimps and tilapia. The tremendous potential of the pangasius sector directs the attention of world fisheries market. In turkey, there is not a recorded pangasius production data. There have been cultivated as a hobby for the aquarium fish.

In this study, information regarding general characteristics and production techniques of pangasius fish has been presented and samples from around the world have been addressed. The purpose of this research when the state and contribution of the genus pangasius, which is accepted as fast growth, a significant food source for having high protein rate and being able to adapt to various food diets, are considered, pangasius aquaculture in an aqua environment suitable for its environmental demands is the contribution to the development of fisheries. Also, it might be targeted to provide energy conservation and decrease the costs of aquaculture by obtaining the necessary hot water supply from geothermal sources, which have high potentials and which are sustainable, renewable and cheap.

Keywords: pangasius spp., pangasius catfish, aquaculture, sustainable aquaculture

1. INTRODUCTION

Pangasius aquaculture first began in 1940s in Vietnam with fingerling of captured in small ponds and in the nature. At the beginning of 1960s, small-scale cage cultures which were direct source of income in Mekong River have been determined. Pangasius aquaculture has moved to fingerlings production in hatcheries at the beginning of 2000s. Recently, Pangasius production in Vietnam is 269 tons per yield and total annual production is between 500 to 600 tons per hectare. This rate is among the highest rates in the world (Sustainable Fisheries Partnership, 2012).

According to the FAO statistics global pangasius production was below 5000 tons between the years 1970 and 1980 and between 2008 and 2010 total production amount has exceeded one million tons. Global Pangasius Production values, which are obtained by aquaculture; between 1982 and 1996 production values have not exceeded 600 tons. In 2010 these values reached to 1.344.722 tons. Global Pangasius Values which are obtained by captured are as follows; between 1970 and 1973 it was below 2000 tons. Between 2000 and 2010 there was a boom in values in comparison to the averages of other years and values obtained from capture with Global Pangasius Values reached to 19.224 tons (FAO, 2012).

The genus pangasius is not officially produced in Turkey. Aquarium fishing for recreational purposes is more common. One of the main reasons of this is the necessity of high temperatures and not being resistant to temperature changes.

The purpose of this research when the state and contribution of the genus pangasius which is accepted as fast growth, a significant food source for having high protein rate and being able to adapt to various food diets, are considered, pangasius aquaculture in an aqua environment suitable for its environmental demands is the contribution to the development of fisheries. Also, it might be targeted to provide energy conservation and decrease the costs of aquaculture by obtaining the necessary hot water supply from geothermal sources, which have high potentials and which are sustainable, renewable and cheap.

2. GENERAL CHARACTERISTICS

Pangasius sp. is known as the catfish belonging to Siluriformes order Pangasiidae family and lives rivers. It is considered as economically important food fish because of its fast growth, versatile feeding habit and hardiness (Ayson, 2008).

2.1. Morphological Characteristics

The body is laterally compressed. They have two long pair barbels; one pair in the maxilla and one pair in the mandibular. Eyes are commonly small, but may vary depending on the genus. Nose is relatively short (Gustiano and Pouyaud, 2008). The genus may weigh up to maximum 300 kg (Pangasius gigas) (Fishbase, 2013). The body of a healthy individual has a bright colour. Its dorsal is dark green and black, the ventral is silver and the lateral has apparent light strips (Meenakarn, 1986). Flesh of the fish ranges in colour from creamy white to orange with a mild flavour and a medium firm texture (Ayson, 2008).

2.2. Environmental Requirements

Pangasius is indigenous to the major rivers, reservoirs and swamps in Thailand and the Mekong River Basin. In order to produce quality individuals, some production parameters are required. The water temperature must be between 26 to 30°C (Ayson, 2008). An experiment on the finger-sized individuals in the aquarium environment was observed acclimated to 30°C showed restlessness, escape attempts at 39°C, settled to the bottom of the aquarium at 41°C, unorganized swimming with intermittent swift movements was noticed and fish tried to jump out of the aquarium at 42°C (Debnath et al., 2006). The amount of suitable dissolved O_2 is 5 to 6 mg/lt. The lowest level it can tolerate is 0.1 mg/lt. Pangasius spp. is an air-breathing fish thus it can tolerate low oxygen. It is indigenous to water with 2 ppt salinity content rate utmost. Optimum pH values it can survive are between 6 to 7.6 (Ayson, 2008).

2.3. Feed Requirements and Feeding

Pangasius genus is omnivores. It can feed on indigenous feed such as vegetable trimmings, rotten fruits, snails, kitchen leftovers and others. (Ayson, 2008).

According to PAD; eFCR rate should be less than 1.75 during the whole production period (Haque, 2009). The average eFCR rate is 1.68 (Khoi, 2007). Fry fish prefer to eat small aquatic animals between 2^{nd} to 20^{th} days, including small water fleas called Moina and Tubifex (Meenakarn, 1986). Pangasius can be fed with pelleted commercial fish feeds at a rate of 5% of their average body weight and will be adjusted two-weekly down to 2.5% at end of culture period (Ayson,2008). Feeding may be done 2 to 6 times a day (Phan et al., 2009).

2.4. Reproduction Characteristic

Spawning period is between February and October. The brood-stocks are usually selected according to its maturity and health state (for female smooth colour and size, for male milt quality) for spawning. Sexual maturity age is known to be 3 or $3^{1/2}$ years. The most quality egg and milt are obtained from 6 years old individuals. However, in some fish farms it has been observed that too young (2-$2^{1/2}$ years old) or too old (7 to 10 years old) brood-stocks are used and thus fertilisation rates fall (Phuong et al., 2009). As conditions get worse, the period of reaching sexual maturity lengthens (Department of Trade and Industry, 2010).

Reproduction temperature has been determined as 26 to 28°C. Average egg yield is 500 g for a 5 kg of female. Sex ratio ranges from 1:9 or 1:2 male and female (Khoi, 2011). The ventral surface of a female who has eggs in her gonads is bigger compared to males, red and soft. Besides, urogenital zone is swollen and oval. Male has a slim body and his ventral is not swollen. Urogenital zone is narrow and small (Department of Trade and Industry, 2010). Fertilised egg should be spherical, bright and light yellow and have a size of bigger than 1 mm. (Phuong et al., 2009).
Catfish belonging to the genus pangasius and order Siluriformes tend to migrate like other bullheads. In October, at the beginning of the dry season the falling water levels may trigger the fish to migrate to high water areas and main river channels. In the dry season, the fish migrate to the Upper Mekong River and may reach almost downstream. Migrations are seen under the lunar effect, in full moon or just before full moon. Migrations are seen in February. In November and December migrations hit the top. The moonsoon season (May to June), which comes after the dry season, triggers the full grown individuals for spawning migration. Juveniles migrate downstream with the help of floods (Burnhill, 2006).

Hormones were begun to be used for pangasius genus in 1995. Due to the hormones used in broodstock, the aquaculture techniques of fry fish have been developed significantly, the supply of fingerling individuals has increased and has contributed commercial production to grow rapidly. Hormones are used as follows: The selected fish is placed in the tank. Females are induced with hormone injections to spawn 2 to 4 times. In operators; however they are injected twice in eight hour intervals. The first injection dosage is 500 IU/kg; the second injection dosage is 2.000 IU/kg. In order to increase the effect value of the hormone, Ovaprim (Domperidon) is injected. In females Ovaprim is injected 0.6 ml/kg in the first injection and 0.3 ml/kg following the second injection. Egg is taken 8 to10 hours after the second injection. In males, 3.000 IU/kg is injected once during the first injection of the female (McGee and Mace, 1997).

Larvae are 3 mm in height. From the 10th day, larvae are called "fry". At the end of the 9th week, fry weighs 15 g and grows to a size of 10 to 15 cm. Then they are called fingerling. Fingerlings are cultured either according to the determined production systems or sold to hatcheries (Khoi, 2007).

3. PRODUCTION TECHNIQUES

There are three production systems in pangasius farming: ponds, cages and net pen. Pangasius are mostly produced in small-scale ponds (World Bank, 2006). 1.5 to 2 m deep ponds are necessary for the pangasius to grow (Ayson, 2008). When suitable feeding and management are considered, they can grow up to 1.5 kg in 5 to 6 months (Khoi, 2007). A suitable net should be used for harvesting. Open systems, like floating cages are designed to keep a continuous water exchange environment by utilizing the current river water as much as possible. In comparison with ponds, cages allow higher fish densities and have a higher productivity. The density of cages is high in areas where the water current is strong. Harvest is easier in comparison with ponds. To culture in enclosures, nets or fences are used to isolate a section of the river. The ground of the enclosure is the river floor, which contributes to a reduced need for construction material. Another advantage of this type of enclosure is that the amount of wasted feed is lower compared to cages (Khoi, 2011). Maximum fish density at any time for ponds and pens; 38 kg/m^2 and for cages 80 kg/m^3 (The Pangasius Aquaculture Dialogue, 2010).

The most popular cultured pangasius species in the world are as follows: *Pangasius djambal*, *Pangasius bocourti, Pangasius sanitwongsei,* and *Pangasius hypophthalmus* (McGee, 1997). Under the integrated pangasius production system, in a poly-culture trial done with tilapia a daily average 1.5 kg growth rate and 100% survival rate have been obtained. In organic agriculture system, a daily 3 g of growth and 90% survival rate have been obtained. By using commercial feed, a daily 5.5 g growth rate and 90% survival rate have been obtained (Palma, 2009). Six most popular species used in pangasius poly-culture production in Mekong River Delta are *Pangasius hypophthalmus, Cyprinus carpio, Helostoma temminckii, Barbus choloensis, Oreochromis niloticus, Osphronemus goramy* (Thompson and Crumlish, 2001).

Pangasius can be harvested for about 5to6 months of culture period. It can reach the weight of 1 to 1.2 kg in 5 to 6 months of culture period. Pursue seine is used for partial collection (Ayson, 2008).

4. CONCLUSION

The available global geothermal capacity has reached to 11.224 MW by May, 2012 (Jennejohn et al., 2012). Turkey is among the first five countries in geothermal heating and thermal spring applications. Again, in terms of geothermal source richness Turkey is the seventh country in the world. By using the current potential, it is possible to meet the 5% of electricity need and 30% of heating demand by geothermal energy. The use of geothermal energy use increases more rapidly in comparison to solar powered aquaculture heating systems. Geothermal heat enables to control the pond temperature and thus optimum development is obtained. There are three kinds of geothermal based aquaculture systems which are commonly used in accordance with water flow: Closed systems, semi-closed systems, open systems (Erden, 2005).

Closed systems should be preferred in pangasius species culture. In high-tech closed systems optimum cleaning is provided by refining the water without water flow and most importantly there is not heat loss. Considering all these reasons, waters of Turkey might be suitable for pangasius species culture. When the fact that pangasius species are high in protein, are used as aquarium fish and have a rapid

growth rate and its place in the global economy are examined, it is seen that the species is suitable in terms of culture.

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Landfill Gas to Energy in Turkey: Current and Future

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Abstract: The municipal solid waste processing, landfilling and utilization of the gas to generate electric power and lower the emissions have been used in developed countries for decades, however it is relatively new in Turkey. The new regulations force municipalities in the country to build landfills to safely store the waste and secure the emission gases. The landfill gas can be utilized to produce energy and heat or if the quality is high it can be transported to a natural gas pipeline. In this paper, an overview of landfill gas to energy plants in the world is presented, and the situation in Turkey is analyzed.

Keywords: landfill gas to energy, municipal solid waste, methane, emissions, simulation, landfill.

1. INTRODUCTION

The storage and elimination of municipal solid waste (MSW) has became a problem of science and technology especially after the growth of urban areas and population. One common way to handle the MSW is the landfilling the wastes and utilize the landfill gas (LFG) in some ways such as flaring, power generating, or heating. The idea behind the methods is same and it is to control the outputs of wastes and limit the environmental impacts. Additionally recycling the energy content of waste to another energy type and generate extra benefit out of it is another objective. The GHG emissions released from the waste increases the pollution level and cause an explosion danger if the methane (CH_4) level increases. The economic, environmental and safety issues related with MSW handling force governments to

develop policies for waste processing. However, there is still a considerable amount of difference between developed countries and under-developed or developing countries in terms of MSW handling and landfilling. For example almost no country in Africa continent still has active landfill project whereas almost all European countries have. Global initiatives about the protection of the environment and the increase in energy demand force all countries to consider building the landfill projects. The collected LFG can be flared to generate heat for the boilers, space heating, cooling or co-firing. The higher quality of LFG can be utilized and transported to natural gas network to be used as fuel. It is also possible to use LFG in chemical manufacturing industry and soil remediation. When it is economical, the preferred option of LFG usage is to utilize the collected gas to generate electric power.

(Jaramillo and Matthews, 2005) present a work on the net private and social benefits of LFG to energy projects in US. They do a background analysis, technology overview, economic analysis and present case studies which LFG to energy project planners can use directly to evaluate the potential and feasibility of a particular landfill location. (Themelis and Ulloa, 2007) provide an overview of CH_4 generation process in landfills and then show a good overview of LFG utilization in US states. It is estimated that 13% of greenhouse gas emissions (GHG) in the world are generated from solid waste and US has landfills to utilize to lower the emissions. (Hao et al., 2008) show the LFG utilization in the world along with available technologies and total energy and environmental benefits can be gained when the LFG to energy option is used. They analyze the landfills in Hong Kong and do an economic feasibility analysis for the case studies particularly to analyze the feasibility of trigeneration technology. (Willumsen, 2003) analyzes the LFG to energy plants in the world showing the number of plants in each country and generating capacity. (Qin et al., 2001) discuss the details of fundamental and environmental aspects of LFG to energy process. They analyze the effect of gas mixture on burn efficiency and emission outputs. (Bove and Lunghi, 2006) analyze the traditional and innovative technologies that are used in LFG based energy generation. They first show the LFG generation phases and compare the available technologies that can be used for power generation and then present an economic analysis based comparison for case studies. (Thompson et al., 2008) aim to determine targets and strategies to reduce GHG emissions from landfills by modeling LFG generation process. (Balat, 2007) provides an overview of biofuels and policies in European union showing the sources and distribution of each

country. (Kaygusuz and Turker, 2002) present a work for the biomass energy potential of Turkey. (EPA, 2011) provide a good database for LFG generation models and technologies. A spreadsheet based LFG generation estimation tool called landgem is provided along with different LFG generation models for China, Colombia, Ecuador, Ukraine, Mexico, Phippines and Thailand. (Shin et al, 2005) do a scenario analysis for the utilization of LFG to energy in South Korea considering other fuel resources and possible growth scenarios. (Ediger and Kentel, 1999) present an evaluation study for the renewable energy sources in Turkey.
The research about the utilization of MSW and LFG in Turkey is limited in literature. A LFG generation model that is developed for Turkey and a research for the potential of LFG to energy plants and its effect of GHG reduction should be analyzed. The objective of this research is to evaluate the current status of Turkey and compare the status with other countries.

2. LFG TO ENERGY GENERATION TECHNOLOGY

The first step should be to determine if the CH_4 gas generation in landfill site is sufficient to support a power plant. The possible screening criteria might include minimum MSW amount, depth, annual precipitation, the close date of the landfill, and waste that can be provided to support the landfill. If the landfill passes the first screening process, the next step should be to estimate the gas flow per year that will show the amount of power that can be generated. Landgem is one of the option that can be used at this step (EPA,2011).

The municipal solid waste is collected and the landfill area is closed to additional waste placement. LFG generation may begin as soon as the waste decompose begins and the gas can be collected for the utilization. The typical way to collect the gas is to embed vertical wells to the waste area to collect the gas outputs from the decomposed waste. The wells are connected to a lateral piping system which pumps gas to a central manifold for further processing. Horizontal piping that is used especially for deeper landfills is another option for gas collection. It is also common to use a mix of vertical and horizontal piping for landfills. The content of the produced LFG varies and depends on the waste composition. However, typical LFG contents can be summarized as in Table 1 (Hao et al., 2008; Bove and Lunghi, 2006; Themelis and Ulloa, 2007).

Table 1. Typical components of a LFG

Constituent gas	Average concentration
Methane (CH_4)	50%
Carbon dioxide (CO_2)	45%
Nitrogen (N_2)	5%
Oxygen (O_2)	<1%
Hydrogen sulfide (H_2S)	21 ppmv
Halides	132 ppmv
Non-CH_4 organic compounds	2700 ppmv

Almost 95% of LFG consists of CH_4 and CO_2 which are accepted as harmful for the environment if not prevented. The global warming potential of CH_4 is 23 times higher than that of CO_2 which increases the importance of CH_4 capture. The released CH_4 and CO_2 have potential of harming the vegetations and causing undesired odors. Besides when the CH_4 concentration in air reaches 5-15%, an explosive mixture is formed that causes an unsafe condition for the public (Hao et al., 2008; EIA, 2011).

In a LFG to energy system, the LFG collection system is connected to a power generator that typically uses gas as the energy resource. The common electricity generation technologies can be classified as reciprocating internal combustion engine (RICE), gas turbine (GT), steam turbine (ST), stirling cycle engine, and fuel cells. The newly developed combined heat and power (CHP) systems are also able to produce both heat and electrical power. Table-2 shows the technologic and economic characteristics of different power generation technologies from LFG ((Bove and Lunghi, 2006; Hao et al., 2008; EPRI, 2002).

Table-2. Techno-economic characteristics of LFG to energy technologies

Characteristics	RICE	Gas turbine	Stirling engine	Steam turbine	Fuel cell
Applicable size range (kW)	500-25000	500-25000	1-200	25-25000	5-2000
5-year project cost ($/Kw)	300-1300	700-900	2000-36000	800-1000	2000-3000
Electrical efficiency (%)	25-45	25-40	38.5	30-42	45-50
Maintenance cost ($/Kw)	0.007-0.015	0.002-0.008	0.005-0.01	0.004	0.005-0.015
NO_x emission (g/KWh)	2.72	0.73	0.15	0.95	Trace
CO emission (g/KWh)	2.72	0.91	0.75	1.63	0.68

%70 of LFG to energy projects employs RICE technology as it has higher efficiency rate, with lower cost, and relatively higher emission rate. Although the RICE is more suitable for small-sized generation plants, it is also possible to use multiple generators together to get a higher generation capacity. The gas turbines are usually preferred for large projects and stirling engines for much smaller landfills which often times might be the case (EPA, 2011). The GHG outputs of the landfills are decreased if proper LFG control technologies are used. The 60-90% of the CH_4 that is generated in a landfill will be captured depend on the design and effectiveness of the system. This method directly reduces the GHG emissions as the captured CH_4 is burned to produce electricity or heat. On the other hand, the energy that is gained from the LFG displaces fossil fuels that are needed to generate the same amount of energy. Hence, the GHG outputs from such fuels will be saved indirectly.

The LFG generation process can be summarized in 5 phases. After the waste is closed, the first phase is aerobic decomposition in which the waste is decomposed and digested with the air. This period can take one year and less CH_4 is generated. The second phase is anaerobic-acidogenic phase in which CO_2 generation is increasing and energy release rate is low due to the anaerobic conditions. In the third phase the energy release increases as the CH_4 generation increases due to the oxidation of acids and alcohols. In methanogenesis phase, products are converted to CH_4 and CO_2 of which the amount depends on the waste content. This is the

longest phase and much energy is gained during this phase. In the last step which is called maturation the gas and energy generation decrease.

3. LFG TO ENERGY IN TURKEY AND WORLD

The LFG generation depends on the amount of landfilled waste, the mixture of the waste, and the physical structure of the environment where the waste is disposed. In USA, 250 million ton of MSW were produced in 2008 and 54% of the waste was landfilled. Each million ton of waste is able to produce roughly 4465000 (m^3) LFG each year for up to 30 years after landfilled and roughly 284 MWh/year of power can be generated using the LFG with various technologies. There are more than 500 LFG energy projects currently operating in US of which 354 of them generate electricity and remaining projects provide heat and pipeline gas. It is estimated that 13000 GWh/yr electricity is generated and 100 billion cf of LFG is produced for heating and pipelines.

In Europe on the other hand, the LFG projects are widely used for waste disposal. Germany, UK and Italy are three countries with largest number of LFG to energy plants respectively. Table 3 shows the distribution of LFG to energy plants in the world (Willumsen, 2003; Hao et al., 2008; EPDK, 2011).

Table 3. LFG to energy projects in the world

Country	Plants	Capacity (MW)	Country	Plants	Capacity (MW)
Australia	18	76	Latvia	1	5
Austria	15	22	Mexico	1	7
Brasil	7	11	Norway	30	28
Canada	15	106	Poland	19	18
Check Republic	6	7	Portugal	1	2
China	4	4	South Africa	4	4
Denmark	23	22	Spain	14	36
Finland	14	12	Sweden	61	55
France	26	30	Switzerland	7	7
Germany	182	270	Taiwan	4	20
Greece	1	13	Turkey	6	39
Holland	47	62	UK	151	320
Hongkong	8	32	USA	354	2378
Italy	135	362	**Total:**	**1157**	**3694**
Korea	3	16			

It is shown that the utilization of LFG is increasing as the population density and development level increases. The utilization of LFG in Turkey is new and the efforts have begun after 2000. The explosions of waste disposal sites in 90's, the environmental regulations and the efforts to integrate to European Union have forced Turkey to take new precautions for the handling of wastes. The new legislations which came to play in 2005 about the processing of MSW brought regulations for municipalities to build landfills for the disposal of the MSW. Furthermore minimum price and purchase guarantee are provided for the electricity produced from LFG. As a result, new plants were build and municipalities are planning new facilities. Table 4 shows the current LFG plants in Turkey (EPDK, 2011).

Table 4. LFG to energy projects in Turkey

Name of the LFG plant	City	Under construction (MW)	Active (MW)	Total (MW)	Year begin	Operating period
ICKAMD	Istanbul	0	4.02	4.02	2003	10
Odayeri	Istanbul	0	13.86	13.86	2009	24
Komurcuoda	Istanbul	1.76	7.56	9.32	2009	23
ITC-KA	Ankara	0	11.3	11.3	2006	49
EEAS	Istanbul	5.23	0.98	6.218	2004	49
Aksa	Bursa	0	1.39	1.39	2003	20
CEV Energy	Gaziantep	2.3	0	2.3	2011	49
	Total	9.29	39.11	48.40		

The flaring of LFG in landfills reduces the GHG in MSW and hence decreases GHG contribution to total emissions. Figure 1 shows the share of waste based GHG emissions on total emissions both in Turkey and 27 European countries (EC, 2011).

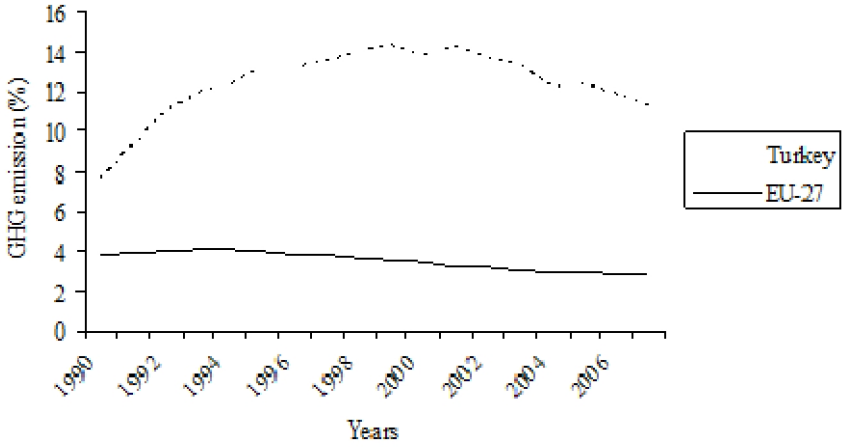

Figure 1. Percentage of waste based GHG emissions in Turkey and Europe

Notice that when the LFG plants increase, the contribution of waste to emissions decreases. There is a huge difference between Turkey and Europe and the way to decrease the gap is to build LFG plants to flare the LFG.

6. COCLUSION

It is important to utilize the energy sources efficiently in an environment where the demand for energy, the cost of fossil based power generation and the amount of emissions are increasing. The investment for renewable energy sources such as wind and hydro accelerated as a response to the increasing energy demand. The developed countries increase their investments on the efficient storing of MSW in landfills and energy or heat generation from LFG. In this paper, an overview of LFG usage in the world is presented, and then the situation in Turkey is explained. It is estimated that if the current projects are completed, the emissions can be decreased to a level that is very close to European standards and MSW can be utilized to generate more electric power.

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Several Internal Myxozoan Parasites on Cultured Sea Bass, *Dicentrarchus labrax* and Gilthead Sea Bream, *Sparus aurata* in Mediterranean Region

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Abstract: Aquaculture production in the Mediterranean has been expanding rapidly over recent years. In the Mediterranean region, European sea bass (*Dicentrarchus labrax*) and gilthead sea bream (*Sparus aurata*) are the most important commercial cultured fish species. Increasing in aquaculture activities bring out the risk of emergence of parasitic diseases which responsible for economic losses. Infections of parasites belonging to phylum Myxozoa is generally seen as fish parasites. Myxosporean is an affective parasite group for marine and freshwater fish and causing important economic losses. In this presentation contains the important myxosporean parasites in culture of sea bass and sea bream. Especially, certain investigations are given including Myxosporean parasites observed on sea bass and sea bream, and their general characteristics of these parasites were given.

Keywords: myxosporea, dicentrarchus labrax, sparus aurata, ceratomyxa spp, sphaerospora spp, myxidium spp

1. INTRODUCTION

In the Mediterranean aquaculture production has been improving rapidly over recent years. Increasing in aquaculture activities bring out the risk of emergence of parasitic diseases which responsible for economic losses. The most important

parasites for cultured sea bass and/or sea bream are *Trichodina* spp, *Ichthyobodo* spp, *Amyloodinium ocellatum, Furnestinia echeneis, Microcotyle chrysophrii, Diplectanum aequans, Caligus minimus, Lernanthropus kroyeri* and *Meinertia oestroides* (Tokşen et al., 2010). In addition to these parasites, myxosporeans are also the effective fish parasites and their infection occurs in a wide range of both marine and freshwater fish species.

Among the large number of myxosporeans in which a serious pathogenic potential has been recorded, many infect feral or thrash fishes (Lom & Dykova, 1992), and they are responsible for economic losses among fisheries and aquaculture industries (Sitja-Bobadilla, 2008).

Accordingly several researchs the myxozoan pyhlum comprises more than 2180 species, most of which are fish parasites, and infect any tissue and host organ (Lom & Dykova, 2006; Sitjà-Bobadilla, 2009).

The most of myxosporean parasites damage in various organs of the fish species. Members of several genera of myxosporeans infect intestinal tissues, although relatively few are exclusive pathogens of the intestine. Most infections are not regarded as pathogenic, typically forming discrete sporogonic cysts with minimal localized host reaction to the parasites. A large number of coelozoic myxosporean species inhabit the gallbladder, especially in marine fish, and most infections are rather innocuous, without a significant host response. Infection proceeds via the hepatic vascular system into the biliary ductile (Woo, 2006).

Lom & Dykova (1992), point out the prevalence of a myxosporean infection in a particular fish host in a given locality is the result of the interaction of many factors. This research represents the myxosporean parasites causing problems in sea bream and sea bass culture. Thus, the most important myxozoans, *Ceratomyxa* spp, *Sphaerospora* spp, *Myxidium* spp are given in below.

2. MYXOZOAN PARASITES

2.1. Ceratomyxa spp

According to Lom & Dykova (1992) *Ceratomyxa* spp have elongated crescent-shaped or arcuate spores with shell valves often conical, exceeding in length the axial diameter of the spore; subspherical polar capsules have capsular foramina near the sutural line at the anterior pole of the spore; exceptionally the polar capsules open at opposite sides of the central sutural line; binucleate sporoplasm does not completely fill the spore cavity; two uninucleate sporoplasms were also reported; trophozoites mono-to polysporic, usually disporic; coelozoic in marine fishes, exceptionally in freshwater or rarely histozoic.

This genus includes a lot of marine species, and some of them cause significant pathological problems for sea bass and sea bream culture. The main species were recorded in cultured marine fish are *C. diplodae, C. labracis* and *C. sparusaurati.* Oftenly, *C. labracis* observe in wild and cultured seabass (Athanassopoulou et al., 2009).

2.1.1. C. sparusaurati

Accordig to Eiras (2006), morphology of *C. sparusaurati,* anterior margin convex and posterior straight or slightly concave; spores are somewhat crescentic; valves equal with rounded extremities; the measurment of spores 5.6 (4.5– 7.5) µm x 15.7 (14–17.5) µm; polar capsul is subspherical, 2.7 (2.2–3.4) µm; number of coils of the polar filament is 6.

C. sparusaurati is a very common parasite of the gallbladder of *Sparus aurata* (Bartošová, 2010). Localization of trophozoites, disporous sporoblasts, and spores of *Ceratomyxa sparusaurati* is found mainly in the gallbladder, though parasitic stages could also be detected in the biliary ducts and intestinal epithelium (Bartošová, 2010; Palenzuela et al., 1997).

In the infected gallbladders histopathological damages such as swelling, vacuolization and sloughing of the epithelial cells were observed. TEM observations

also were shown a characteristic protrusion of the epithelial cell surface and mitochondrial alterations in infected tissues (Palenzuela et al., 1997).
According to Woo (2006) and Palenzuela et al., (1997), enlarged gallbladders and abdominal distension are presented and mortality, abdominal inflammation and ascites are observed massive infectionsin fishes.

2.2. Sphaerospora spp

Sphaerospora dicentrarchi and *Sphaerospora testicularis* are common parasites of European sea bass (*Dicentrarchus labrax*), a popular Mediterranean aquaculture species, that eventually cause the parasitic castration of valuable broodstock males (Sitja-Bobadilla & Alvarez-Pellitero, 1993).

2.2.1. Sphaerospora dicentrarchi

The myxozoan *Sphaerospora dicentrarchi* infects in intestine, gallbladder, stomach and other internal organs in sea bass. According to Mladineo (2005), prevalence and amounts of this infection decreases warm months and increases cold months in Adriatic Sea. Beyazıt et al. (2013) stated that the prevalence range is in spring and summer more than in winter and autumn in the Aegean area.
Sphaerospora dicentrarchi causes infection in almost every organ of the host, although locations of its are the connective and muscular tissues of the gallbladder and intestine (Alvarez-Pellitero & Sitjà-Bobadilla, 1993).

2.2.2. Sphaerospora testicularis

Sphaerospora testicularis parasitize the reproductive tract of the fish. The epidemiological data on *Sphaerospora testicularis* spreads from fish to fish (Bartošová, 2010).

Infection occur sea bass testes. The myxozoan *Sphaerospora testicularis* develops within the seminiferous tubules. Extensive granulomatous lesions and focal necrosis can observe. Sometimes abdominal distension and ascites are observed. *S. testicularis* is a coelozoic parasite that causes extremely pathogenic effects to infected testes (Sitjà-Bobadilla & Alvarez-Pellitero, 1992). The pathology of *S. testicularis* includes the destruction of both testicular germinal cells and Sertoli cells, and leading to castration (Toledo-Guedes, 2012)

According to Sitjà-Bobadilla (2009), infection occurs abdominal swelling in the spawning season of European sea bass because of the accumulation of ascites or gonad hypertrophy. The genital pore can appear extended and reddish. Testes can sometimes be hyaline or yellowish with haemorrhagic foci. Appearance of infected testes necrotic, hardened and much larger than non infected testes at the end of this period is observed.

2.3. Myxidium spp

Myxidium spp has over 150 described myxozoan species and they are spreaded worldwide marine and freshwater fishes. Most Myxidium species are coelozoic parasites causing infection in the gallbladder, urinary bladder, or urinary tubules in the kidneys of fish hosts (Jirků et al., 2006).

2.3.1. Myxidium leei

Myxidium leei is one of the most affective myxozoan diseases of cultured Mediterranean fish species. It is serious parasites commonly in sparids including gilthead sea bream (*Sparus aurata*) are host for this parasite. This parasites cause severe enteritis, malnutrition and sepsis.

Enteromyxum (=*Myxidium*) *leei* (Myxosporea) were identified in freshly prepared microscope smears. *E. leei* was diagnosed in intestinal mucosa. In additional when present, they could be observed in paraffin sections of infected intestine[1].

Anorexia, weight loss, anaemia, emaciation and mortality can observe as the symptoms of *Myxidium leei* infections. *Myxidium leei* harbours in gallbladder, gut and rarely gills (Rigos et al., 1999). The infection of *Myxidium leei* in the intestinal mucosa is a serious problem, causing emaciation to host. The parasite invades the intestinal tract causing severe chronic enteritis that frequently causes emaciation and death. Losses of fish stoks reach 80% of some stocks, especially in *P. puntazzo*, which seems to be the most susceptible sparid (Kent etal, 2001) *Myxidium leei* disrupts intestinal water uptake, degradation of hepatic function in infected fish (Sitjà-Bobadilla & Palenzeula, 2012).

Toltrazuril has been suggested that in Mediterranean fish, it is effective for treatment of Myxosporean infections including *Myxidium leei* (Athanassopoulou et al., 2009).

The combination of salinomycin and amprolium significantly reduce prevalence, intensity and mortality in infection of *M. leei* in sharpsnout sea bream, and toxic effects were not appeared (Golomazou et al., 2006).

Using other drugs, in *Myxidium leei* infections, such as fumagillin or the combination of narasin and nicarbazine have toxic effects on the host or increased the mortality rates (Sitjà-Bobadilla & Palenzeula, 2012).

3. CONCLUSION

The aim of this paper is to present general overview of several sea bass and sea bream myxozoan parasites. European sea bass (*Dicentrarchus labrax*) and gilthead sea bream (*Sparus aurata*) are the most important commercial cultured fish species and they play important role in aquaculture production, especially in mediterrian region. Depend on the increase of production amount causes to consist of diseases. Parasitic diseases causing myxozoans affect to aquaculture, indirectly. The prevalance rates of several myxozoan including *Ceratomyxa* spp, *Myxidium* spp and *Sphaerospora* spp lead to extensive losses. Absence of sufficient efficiently drugs or treatment methods expand to outbreaks of disease probability with other factors, such as temprature, stock density, stress and etc.

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Microalgae And Their Cultivation System To Produce Biodiesel

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Abstract: Biodiesel is an alternative fuel for conventional diesel that is made from natural plant oils, animal fats, and waste cooking oils. This paper discusses the producing biodiesel fuel from algae. Algae range from small, single-celled organisms to multi-cellular organisms, some with fairly complex and differentiated form. Algae are usually found in damp places or bodies of water and thus are common in terrestrial as well as aquatic environments. Like plants, algae require primarily three components to grow: sunlight, carbon-dioxide and water. Photosynthesis is an important bio-chemical process in which plants, algae, and some bacteria convert the energy of sunlight to chemical energy. Micro-algae contain lipids and fatty acids as membrane components, storage products, metabolites and sources of energy. Algae contain anything between 2% and 40% of lipids/oils by weight.

Keywords: biodiesel, algae, biomass, energy

1. INTRODUCTION

Biodiesel is renewable energy made available from materials derived from biological sources. Due to volatile and rising energy prices as well as increasing world wide energy demond, bioenergy is seen by many nations as an attractive alternative or addition to meet their current and future energy needs. Many countries accept biodiesel as a way to diversity their current energy mix, reduce dependency on fossil fules such as forestry and agriculture crops, biomass residues and wastes already provide about %14-15 of the worlds primary energy supplies, with the potential to meet up to half of world energy demands during the next century.

Microalgae can provide several different types of renewable biofuels. These include methane produced by anaerobic digestion of the algal biomass (Spolaore et al., 2006); biodiesel derived from microalgal oil (Dunahay et al., 1996; Sheehan et al., 1998; Banerjee et al., 2002; Gavrilescu and Chisti, 2005, Chisti, 2007.); and photobiologically produced biohydrogen (Ghirardi et al., 2000; Akkerman et al., 2002; Melis, 2002; Fedorov et al., 2005; Kapdan and Kargi, 2006). The idea of using microalgae as a source of fuel is not new (Chisti, 1980–81; Nagle and Lemke, 1990; Sawayama et al., 1995), but it is now being taken seriously because of the escalating price of petroleum and, more significantly, the emerging concern about global warming that is associated with burning fossil The mass production of microalgae for lipid production has a long history. Prior to the present interest in producing biofuels to mitigate CO_2 release, there had been an extended period of research interest motivated by security of oil supply. This was initially prompted by the 1973 oil crisis. Algae have long been known to produce a great variety of lipids, hydrocarbons and other complex oils. Cultured algae have been used as feeds for aquaculture applications because of their high content of nutritionally essential polyunsaturated fatty acids. A further motivation for algal culture has been the production of high value by-products such as the pigments astaxanthin (a food colorant and antioxidant from *Haematococcus pluvialis*) and b-carotene (a food additive produced from *Dunaliella* species). These sorts of production processes have been in place since the early 1950s, so many aspects of the technology of mass algal growth may be considered mature. Much historical research has focused on the lipid composition from either a taxonomic or nutritional standpoint. There is, however, a sharp difference between the growth of algae for nutritional and for fuel use. These nutritional products are high value: astaxanthin for example commands a price in the region of $3 million tonnes 1,7 compared with less than a $1000 tonnes 1,0 for crude oil. Thus the economics are profoundly different. As a result, the production of biofuels will require a fundamental change in the approaches to production compared with nutraceutical and aquaculture feed-grade products and without question fresh, major challenges. Algal biomass can serve as a feedstock for the production of a variety of different biofuels, e.g. biodiesel, hydrogen, methane and bioethanol. Furthermore, its production is also being seriously considered for the removal of carbon dioxide from the flue gases of fossil fuel power stations. In order to maintain focus, we limit our discussion to the use of algae as feedstock for biodiesel and biomass production. There have been claims in the literature over recent years hailing algae as the solution to the global energy crisis.

Algae biomass cultivation has four important potentials than other sources. First, algae biomass can be produced at extremely high volumes and this biomass can yield a much higher percentage of oil than other sources. Second algae oil has limited market competition. Third, algae can be cultivated on marginal land, fresh water, or sea water. Fourth, innovations to algae production allow it to become more productive while consuming resources that would otherwise be considered waste (Campell, 2008).

2. POTENTIAL OF MICROALGAL BIODIESEL

Algae can grow practically anywhere where there is enough sunshine. Some algae can grow in saline water. All algae contain proteins, carbohydrates, lipids and nucleic acids in varying proportions. While the percentages vary with the type of algae, there are algae types that are comprised up to 40% of their overall mass by fatty acids (Becker, 1994). The most significant distinguishing characteristic of algal oil is its yield and hence its biodiesel yield. According to some estimates, the yield (per acre) of oil from algae is over 200 times the yield from the best-performing plant/vegetable oils (Sheehan,1998) Microalgae are the fastest-growing photosynthesizing organisms. They can complete an entire growing cycle every few days (Demirbaş and Demirbaş, 2011). Microalgae contain lipids and fatty acids as membrane components, storage products, metabolites and sources of energy. Algae present an exciting possibility as a feedstock for biodiesel, and when you realize that oil was originally formed from algae. As could be seen from Table 1, algae contain anywhere between 2% and 40% of lipids/oils by weight (Becker 1994).

Producing microalgal biomass is generally more expensive than growing crops. Though the algal culture that is not cheaper than other, is environment-friendly form a production. Photosynthetic growth requires light, carbon dioxide, water and inorganic salts. Temperature must remain generally within 20 to 30 °C. To minimize expense, biodiesel production must rely on freely available sunlight, despite daily and seasonal variations in light levels. Microalgal biomass contains approximately 50% carbon by dry weight (Sánchez Mirón et al., 2003). All of this carbon is typically derived from carbon dioxide. Producing 100 t of algal biomass fixes roughly 183 t of carbon dioxide. Carbon dioxide must be fed continually during daylight hours. Feeding controlled in response to signals from pH sensors minimizes loss of carbon dioxide and pH variations. Biodiesel production can

potentially use some of the carbon dioxide that is released in power plants by burning fossil fuels (Sawayama et al., 1995; Yun et al., 1997). This carbon dioxide is often available at little or no cost.

Table 1. Algae contain lipid, oil

Crop	Oil yield (L/ha)	Land area (M ha) [a]	Percent of existing US cropping area
Corn	172	1540	846
Soybean	446	594	326
Canola	1190	223	122
Jatropha	1892	140	77
Coconut	2689	99	54
Oil palm	5950	45	24
Microalgae [b]	136900	2	1.1
Microalgae [c]	58700	4.5	2.5

[a] For meeting %50 of all transport fuel needs of the United States

[b] %70 oil (by wt) in biomass

[c] %30 oil (by wt) in biomass

Table 2. Oil content of some microalgae

Microalga	Oil content
Botryococcus braunii	25-75
Chlorella pyrenoidosa	2
Chlorella vulgaris	14-22
Spirulina maxima	6-7
Spirulina platensis	4-9
Crypthecodinium cohnii	20
Cylindrotheca sp.	16-72

3. MICROALGAL BIOMASS CULTIVATION AND CULTURE SYSTEM

Algae biomass cultivation has four important potentials than other sources. First, algae biomass can be produced at extremely high volumes and this biomass can yield a much higher percentage of oil than other sources. Second algae oil has limited market competition. Third, algae can be cultivated on marginal land, fresh water, or sea water. Fourth, innovations to algae production allow it to become more productive while consuming resources that would otherwise be considered waste (Campbell, 2008). Biodiesel derived from oil crops is a potential renewable and carbon neutral alternative to petroleum fuels. Unfortunately, biodiesel from oil crops, waste cooking oil and animal fat cannot realistically satisfy even a small fraction of the existing demand for transport fuels. Microalgae appear to be the only source of renewable biodiesel that is capable of meeting the global demand for transport fuels.

3.1. Raceway Ponds

A raceway pond is made of a closed loop recirculation channel that is typically about 0.3 m deep. Mixing and circulation are produced by a paddlewheel. Flow is guided around bends by baffles placed in the flow channel. Raceway channels are built in concrete, or compacted earth, and may be lined with white plastic. During daylight, the culture is fed continuously in front of the paddel wheel where the flow begins. Broth is harvested behind the paddlewheel, on completion of the circulation loop. The paddle wheel operates all the time to prevent sedimentation. Production of microalgal biomass for making biodiesel has been extensively evaluated in raceway ponds in studies sponsored by the United States Department of Energy (Sheehan et al., 1998). Raceways are perceived to be less expensive than photobioreactors, because they cost less to build and operate. Although raceways are low-cost, they have a low biomass productivity compared with photobioreactors.

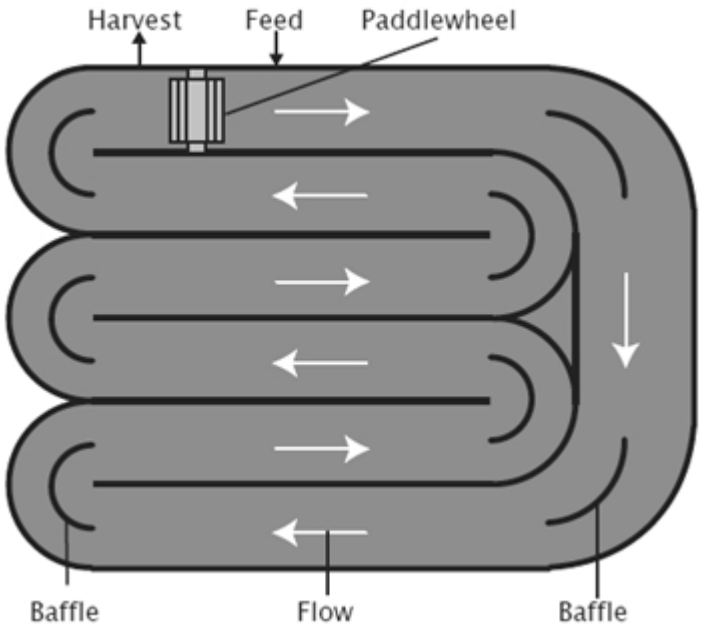

Figure 1. Raceway ponds system

3.2. Photobioreactors

A tubular photobioreactor consists of an array of straight transparent tubes that are usually made of plastic or glass. This tubular array, or the solar collector, is where the sunlight is captured (Fig. 2). The solar collector tubes are generally 0.1 m or less in diameter. Tube diameter is limited because light does not penetrate too deeply in the dense culture broth that is necessary for ensuring a high biomass productivity of the photobioreactor. Microalgal broth is circulated from a reservoir (i.e. the degassing column in Fig. 2) to the solar collector and back to the reservoir. Continuous culture operation is used, as explained above.

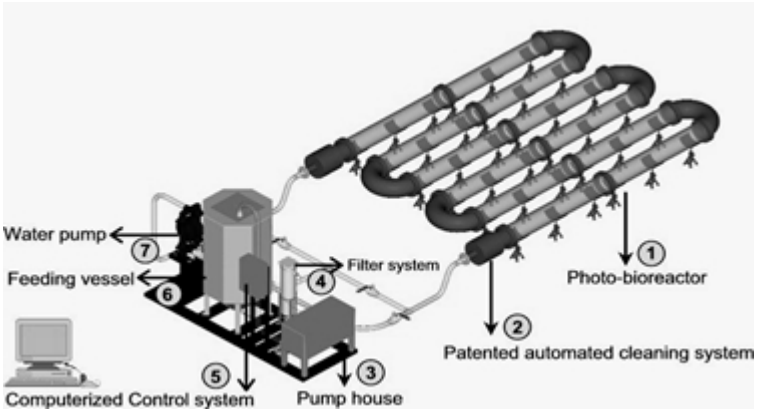

Figure 2. Photobioreactors system

4. COMPRASION OF RACEWAYS AND TUBULAR PHOTOBIOREACTORS

Table 3 compares photobioreactor and raceway methods of producing microalgal biomass. This comparison is for an annual production level of 100 t of biomass in both cases. Both production methods consume an identical amount of carbon dioxide (Table 3), if losses to atmosphere are disregarded. The production methods in Table 3 are compared for optimal combinations of biomass productivity and concentration that have been actually achieved in large-scale photobioreactors and raceways. Photobioreactors provide much greater oil yield per hectare compared with raceway ponds (Table 3). This is because the volumetric biomass productivity of photobioreactors is more than 13-fold greater in comparison with raceway ponds (Table 3). Both raceway and photobioreactor production methods are technically feasible. Production facilities using photobioreactors and raceway units of dimensions similar to those in Table 3 have indeed been used extensively in commercial operations (Terry and Raymond, 1985; Molina Grima, 1999; Molina Grima et al., 1999; Tredici, 1999; Pulz, 2001; Lorenz and Cysewski, 2003; Spolaore et al., 2006). Recovery of microalgal biomass from the broth is necessary for extracting the oil. Biomass is easily recovered from the broth by filtration (Fig. 3), centrifugation, and other means (Molina Grima et al., 2003). Cost of biomass recovery can be significant. Biomass recovery from photobioreactor cultured broth costs only a fraction of the recovery cost for broth produced in raceways. This is because the typical biomass concentration that is produced in photobioreactors is

nearly 30 times the biomass concentration that is generally obtained in raceways (Table 3). Thus, in comparison with raceway broth, much smaller volume of the photobioreactor broth needs to be processed to obtain a given quantity of biomass. (Chisti, 2007)

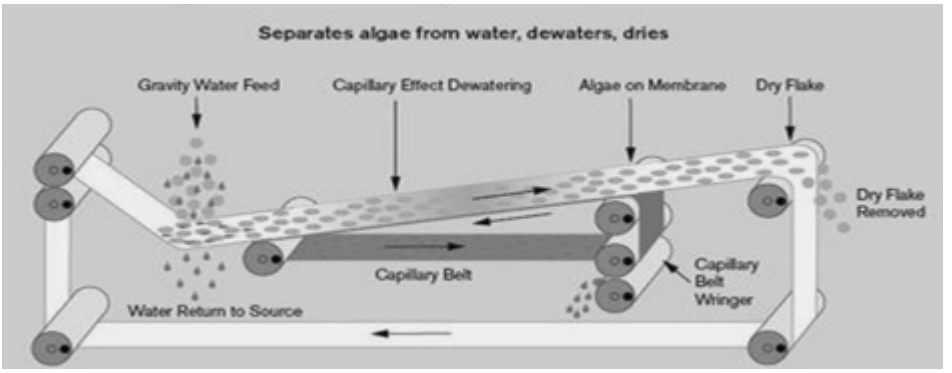

Figure 3. General harvesting of microalgae

Table 3. Comparison of photobioreactor and raceway production methods(Chisti, 2007)

Variable	Photobioreactor Facility	Raceway ponds
Annual biomass production (kg)	100000	100000
Volumetric productivity (kg m^{-3} d^{-1})	1535	0.117
Areal productivity (kg m^{-2} d^{-1})	0.048 a 0.072 c	0.035 b
Biomass concentration in broth (kg m^{-3})	4.00	0.14
Dilution rate (d^{-1})	0.384	0.250
Area needed (m^2)	5681	7828
Oil yield (m^3 ha^{-1})	136.9 d 58.7 c	99.4 d 42.6 c
Annual CO_2 consumption (kg)	183,333	183,333
System geometry	132 parallel tubes/unit; 80 m long tubes; 0.06 m tube diameter	978 m^2/pond; 12 m wide, 82 m long, 0.30 m deep
Number of units	6	8

a Based on facility area.
b Based on actual pond area.
c Based on projected area of photobioreactor tubes.
d Based on 70% by wt oil in biomass.
e Based on 30% by wt oil in biomass

5. RESULTS AND DISCUSSION

There are small numbers of economic feasibility studies on microalgae oil (Richardson, 2009). Currently, microalgae biofuel has not been deemed economically feasible compared to the conventional agricultural biomass (Carlsson 2008). Critical and controversial issues are the potential biomass yield that can be obtained by cultivating macro- or microalgae, and the production costs of the biomass and derived products. The basis of the estimates is usually a discussion on three parameters: photosynthetic efficiency, assumptions on scale-up, and on long-term cultivation issues. For microalgae the productivity of raceway ponds and photobioreactors is limited by a range of interacting issues.
Biodiesel has great potential; however, the high cost and limited supply of renewable oils prevent it from becoming a serious competitor for petroleum fuels. As petroleum fuel costs rise and supplies dwindle, biodiesel will become more attractive to both investors and consumers. For biodiesel to become the alternative fuel of choice, it requires an enormous quantity of cheap biomass. Using new and innovative techniques for cultivation, algae may allow biodiesel production to achieve the price and scale of production needed to compete with, or even replace, petroleum (Campbell, 2008).

6. CONCLUSION

As shown that here, microalgal biodiesel is technically feasible. It is the only renewable biodiesel that can potentially completely displace liquid fuels derived from petroleum. Economics of producing microalgal biodiesel need to improve substantially to make it competitive with petrodiesel, but the level of improvement necessary appears to be attainable. Producing low-cost microalgal biodiesel requires primarily improvements to algal biology through genetic and metabolic engineering. Use of the biorefinery concept and advances in photobioreactor engineering will further lower the cost of production. In view of their much greater productivity

than raceways, tubular photobioreactors are likely to be used in producing much of the microalgal biomass required for making biodiesel. Photobioreactors provide a controlled environment that can be tailored to the specific demands of highly productive microalgae to attain a consistently good annual yield of oil (Chisti, 2007). Algae are an economical choise for biodiesel production because of algae availability and usable.In this way algae can be used as renewable energy resource.Many researchers reported that microalgae might better for higher biodiesel production.But research has not done yet in this regard. Biodiesel from micro algae has not economic and practical product system.

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A Study on Micropropagation as a Tool for Sustainable Utilization of Jujube (*Zizyphus jujuba* Mill.) Genotypes

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Abstract: Micropropagation is as a tool for sustainable utilization and allows the production of a large number of virus-free clones within a short period. Also, micropropagationis fundamental for the conservation of genetic resources. The presentstudy was carried out to establish protocols for the invitropropagation of Jujube (*Ziziphus*spp)and contribute to the conservation of plant geneticresources.In the study, shoot tips of two selected jujube genotypes (20-C-10 and 20-C-22) were used as a material. MS (Murashige and Skoog) medium supplemented with both TDZ (thidiazuron) and BAP (benzylaminopurine) as a cytokinin was used for micropropagation of jujube genotypes. The highest percentage of explants forming shoots (93.3 %) and the highest number of shoot per explants (5.7) was obtained on the MS medium containing 0.1 mg/l TDZ+0.5 mg/l BAP+0.1 mg/l IBA (indolebutyric acid)+0.3 mg/l GA_3(gibberellic acid) in 20-C-10 jujube genotype. The highest rooting percentages of 20-C-10 and 20-C-22 jujube genotypes (83.3 % and 80.0 %, respectively) were obtained on half-strength MS medium supplemented with 2.0 mg/l IBA.

Keywords: jujube, micropropagation, thidiazuron, benzylaminopurine, *in vitro* rooting

1. INTRODUCTION

Jujube (*Ziziphusspp*), also known as ber, is widely distributed in tropical and subtropical climates in the world (Mukhtar et al. 2004). The fruits of *Z. mauritania* and *Z. jujuba* are of economic importance and they are cultivated in several countries such as especially India and China. Jujube is a hardy tree of arid region which can be grown successfully in saline soil under hot, arid environment (Meena et al. 2003). Nevertheless, there is a genetic variation for this species in some parts of Turkey. Its fruits have been consumed in fresh, dried forms and processed (jams, loaf, cakes, jelly etc.) in the world (Pareek, 2002). However, Jujube fruits are generally consumed as dried or fresh in Turkey. Its fruits are acceptable to the taste with a good amount of vitamin A, C and B complexes and minerals (Pareek, 2002; San et al. 2009). In addition that, saponin, alkaloids, tannins, flavonoids, sterols, and fatty acids have been isolated and chemically identified from the different species of the genus *Ziziphus* (Croueour et al. 2002; Abdel-Zaher et al. 2005; Bhargava et al. 2005; Zhao et al. 2008; San and Yildirim, 2010). Besides, jujube fruit has important levels of antioxidant activity and scavenging effect on free radicals because of having a good amount of vitamin and phenolics (Li et al. 2005). Some parts of plant such as seeds, leaves and juice of roots are used in traditional medicine for the treatment of some diseases (Mukhtar et al. 2004, Abdel-Zaher et al. 2005).

Micropropagation is as a tool for sustainable utilization and allows the production of a large number of virus-free clones within a short period. Besides, micropropagation is fundamental for the conservation of genetic resources. In vitro propagation techniques and innovative approaches will be usefulan alternative method for commercial propagation and conservation of jujube. Assareh and Sardabi(2005) reported that micropropagation technique is more favorable than the other vegetative propagation methods for jujube.Also, several researcher have been studied micropropagation techniques such as organogenesis, somatic embryogenesis and shoot tip culture of jujuba (Sudhersan et al., 2001; Danthu et al., 2004; Gu and Zhang, 2005; Kim et al., 2006). However, the development of an efficient micropropagation method is necessary.

The present study was carried out to establish protocols for the in vitro propagation of Jujube (*Ziziphus*spp) and contribute to the conservation of plant genetic

resources. For this purpose in the study, it was determined that the effects of combinations and doses of some plant growth regulators on micropropagation of jujube genotypes, '20-C-10' and '20-C-22' selected from Denizli-Turkey.

2. MATERIALS AND METHODS

The study was carried out in the laboratories of Horticulture Department at Suleyman Demirel University during 2007 and 2008. Shoot tips from adult plants of jujube genotypes '20-C-10' and '20-C-22' selected from Denizli-Turkey were used as a plant material in the study.

2.1. In vitro shoot propagation

To determine the best plant growth regulator combinations for in vitro propagation of jujube, young shoots of jujube genotypes were harvested on May 17, 2007. The shoots were washed under running tap water and disinfected in 3.00 % (v/v) sodium hypochlorite solution for 18 min, followed by three rinses in sterile distilled water for 5 min. Shoot tips (about 0.5 cm) were cultured for 3 weeks in test tubes and subcultured for 4 weeks in erlenmayer flasks on MS (Murashige and Skoog, 1962) medium consisting of 0.5, 1.0 and 2.0 mg/l benzyl amino purine (BAP) or thidiazuron (TDZ) as a cytokinin and 0.01, 0.1 and 0.5 mg/l indole-3-butyric acid (IBA). Efficient proliferation was not provided on MS medium consisting plant growth regulator combinations stated above. Therefore, MS media supplemented with both TDZ and BAP as a cytokinin were tested for micropropagation of jujube. For this purpose, MS media supplemented with different combinations of TDZ (0.1, 0.3 and 0.5 mg/l) and BAP (0.1, 0.3, 0.5 and 1.0 mg/l) were studied. 0.1 mg/l IBA and 0.3 mg/l GA_3 were added in to all media at the same concentrations. Shoot tips were incubated in a room at 25±1°C, under a 16 hours photoperiod provided by cool white fluorescent lamps (140-150 µmol m^{-2} s^{-1}). Two subcultures were made at 4 weeks intervals and at the end of each subculture, the percentage of explants forming shoots and number of shoots per explants were determined.

2.2. Rooting of microcuttings

In order to root the *in vitro* shoots, micropropagated shoots of jujube genotypes were transferred to MS and half-strength MS media supplemented with the

concentrations of IBA or NAA as 0, 0.5, 1.0, 2.0 and 4.0 mg/l. Shoot explants were cultured in a growth chamber at 25±1°C, under a 16 hours photoperiod provided by cool white fluorescent lamps (140-150 µmol m-2 s-1) for 3 weeks. The percentage of rooted shoots and the number of roots per rooted shoot were determined at the end of 3 weeks.

3% (w/v) sucrose and 0.6% agar (w/v) (Merck Co.) were added in to all media at both shoot proliferation and *in vitro* rooting studies and the pH was adjusted to 5.7 before autoclaving at 121°C for 15 min. Each treatment consisted of 3 erlenmayer flasks with 5 explants per flask. Data were subjected to an analysis of varianceusing Minitab software (MINITAB Inc.) and the means were separated by Duncan's Multiple Range test ($P<0.05$). The percent data were transformed into angle values and angle values were used in the variance analysis. In the tables, real values obtained were presented.

3. RESULTS AND DISCUSSION

3.1. *In vitro* shoot propagation

MS medium was successfully used for *in vitro* proliferation of some jujube cultivars in previous studies by some researchers (Kim and Lee, 1988; Yan et al. 1990; Rathore et al. 1992; Foguat et al. 1997; Wu et al. 2004; Sudhersan and Hussain, 2003). Shoot formation was observed on the MS medium containing TDZ alone but shoots were very short and unhealthy. On the other hand, when the medium supplemented with BAP alone as a cytokinin was used as previous studies (Kim and Lee, 1988: Yan et al. 1990; Fougat et al. 1997), explants did not produce the new shoots and the explants turned yellow on the medium. Finally, we used the MS medium supplemented with both TDZ and BAP as a cytokinin for micropropagation of jujube genotypes. TDZ and BAP were more effective in the micropropagation of jujube genotypes when they were used together. Table 1 presents the percentage of explant produced shoots and the number of shoots per explant recorded on MS medium containing doses of both BAP and TDZ as cytokinin. It was found that there were significant differences between treatments based on percentage of explant produced shoots and the number of shoots per explants. While the percentage of explant produced shoots changed from 53.3 % to 93.3 % for 20-C-10 and 26.2 % to 86.7 % for 20-C-22, the number of shoots per

explant changed from 1.47 to 5.70 for 20-C-10 and 1.80 to 4.87 for 20-C-22. The highest percentage of explant produced shoots and the highest number of shoots per explant were recorded from the media containing0.1 mg/l TDZ+0.3 mg/l BAP and 0.1 mg/l TDZ+0.5 mg/l BAP for both jujube genotypes.However, the differences between stated combinations and some of other treatment were not significant (Table 1). The highest shoot numbers were 5.7and 4.87 for jujube genotypes '20-C-10' and '20-C-22', respectively (Table 1). Similar results were also reported by Rathore et al. (1992).Micropropagation of jujube was achieved on MS medium supplemented with 0.5 mg/l BAP or 1.0 mg/l BAP in previous studies(Kim and Lee, 1988; Yan et al. 1990; Fougat et al. 1997). But, the same doses of BAP were not effective on *in vitro* propagation of jujube genotypes in our study. Similar to our results, Jiang et al. (2004) reported that BAP and TDZ were more effective on micropropagation of jujube genotypes when they were used together. Zeatin and kinetin were also used for micropropagation of jujube by other researchers (Wu et al. 2004).

Table 1. The effect of plant growth regulator combinations on *in vitro* propagation of jujube

Plant Growth Regulators Combinations	20-C-10 jujube genotype				20-C-22 jujube genotype			
	The percentage of explant forming shoots		No of shoots per explant		The percentage of explant forming shoots		No of shoots per explant	
0.1 mg/L TDZ+0.1 mg/L BAP*	53.3	c**	2.10	cd	46.6	ab	2.07	c
0.1 mg/L TDZ+0.3 mg/L BAP	80.0	ab	4.27	b	86.7	a	4.87	a
0.1 mg/L TDZ+0.5 mg/L BAP	93.3	a	5.70	a	70.0	a	4.70	a
0.1 mg/L TDZ+1.0 mg/L BAP	80.2	ab	3.07	c	73.4	ab	3.20	b
0.3 mg/L TDZ+0.1 mg/L BAP	66.7	bc	2.17	cd	60.0	ab	2.53	bc
0.3 mg/L TDZ+0.3 mg/L BAP	73.4	bc	2.53	cd	60.0	ab	2.73	bc
0.3 mg/L TDZ+0.5 mg/L BAP	73.3	bc	1.87	cd	53.8	ab	2.10	c
0.3 mg/L TDZ+1.0 mg/L BAP	73.6	bc	1.53	d	33.3	b	1.87	c
0.5 mg/L TDZ+0.1 mg/L	60.0	bc	1.90	cd	46.9	ab	2.00	c

BAP								
0.5 mg/L TDZ+0.3 mg/L BAP	66.8	bc	2.40	cd	53.3	ab	2.33	bc
0.5 mg/L TDZ+0.5 mg/L BAP	53.3	c	1.90	cd	26.2	b	2.00	c
0.5 mg/L TDZ+1.0 mg/L BAP	60.1	bc	1.47	d	26.7	b	1.80	c

* All media also containing 0.1 mg/L IBA and 0.3 mg/L GA_3.

** Values within each column followed by the same letter are not significantly different at $p \leq 0.05$ level

3.2. Rooting of microcuttings

Rooting percentages and number of root per rooted shoots of jujube genotypes '20-C-10' and '20-C-22' were given in Table 2..Generally, the highest rooting percentage and the number of roots per rooted shoot were obtained from half strength MS and MS media containing 2 mg/l IBA. Half strength MS medium was relatively more effective than MS medium on rooting induction of both jujube genotypes although there is not any difference between them statistically. Additionally, the media containing doses of IBA induced higher rooting of microcuttings than those containing doses of NAA. The highest rooting percentages were obtained from half strength MS medium containing 2.0 mg/l IBA for jujube genotypes '20-C-10' and '20-C-22' (83.3 % and 80.0 %, respectively). Generally, different doses of IBA and NAA did not affect statistically the numbers of roots per rooted shoot in the study.Some researchers reported that IBA induced the rooting of jujube microcuttings as similar to our results (Wu et al. 2004; Sudhersan and Hussain, 2003; Du et al. 1997). Wu et al. (2004) reported that shoots of jujube were rooted at 90% on half strength MS medium containing 0.8 mg/l IBA. Additionally, half strength MS medium containing 2.0 mg/l IBA or 1.0 mg/l IBA + 0.05 mg/l IAA increased the rooting percentage of jujube microcuttings (Du et al. 1997).

Table 2. The effects of different IBA and NAA concentrations on rooting of jujube genotypes

Treatments	20-C-10 jujube genotype				20-C-22 jujube genotype			
	Rooting shoots (%)		No of roots per rooted shoot		Rooting shoots (%)		No of roots per rooted shoot	
½ MS	0	h*			0	g		
½ MS+0.5 mg/L IBA	46.7	c-e	1.7	a-c	53.3	a-d	1.9	ab
½ MS+1.0 mg/L IBA	53.3	b-d	1.5	a-c	60.0	a-c	1.7	ab
½ MS+2.0 mg/L IBA	83.3	a	2.1	a-c	80.0	a	2.3	a
½ MS+4.0 mg/L IBA	56.7	bc	1.3	a-c	43.3	b-d	2.1	ab
½ MS+0.5 mg/L NAA	6.7	gh	1.0	c	13.3	e-g	1.2	b
½ MS+1.0 mg/L NAA	23.3	ef	1.7	a-c	10.0	e-g	1.8	ab
½ MS+2.0 mg/L NAA	43.3	c-e	1.6	a-c	53.3	a-d	1.6	ab
½ MS+4.0 mg/L NAA	27.7	d-f	1.4	a-c	6.7	fg	1.8	ab
MS	0	h			0	g		
MS+0.5 mg/L IBA	33.3	c-e	1.3	bc	40.0	b-d	1.6	ab
MS+1.0 mg/L IBA	40.0	c-e	1.6	a-c	50.0	a-d	1.7	ab
MS+2.0 mg/L IBA	73.3	ab	1.9	ab	73.3	ab	2.0	ab
MS+4.0 mg/L IBA	50.0	b-e	2.5	a	36.7	c-e	2.2	a
MS+0.5 mg/L NAA	0.0	h			6.7	fg	2.0	ab
MS+1.0 mg/L NAA	26.7	d-f	2.2	ab	33.3	c-e	1.8	ab
MS+2.0 mg/L NAA	33.3	c-e	1.3	a-c	40.0	b-d	1.7	ab
MS+4.0 mg/L NAA	13.3	fg	1.5	a-c	20.0	d-f	1.5	ab

* Values within each column followed by the same letter are not significantly different at $p \leq 0.05$ level

4. CONCLUSION

As a conclusion, MS media supplemented with BAP alone and TDZ alone was not effective on micropropagation of jujube genotypes '20-C-10' and '20-C-22'. TDZ and BAP were more effective to produce shoot from explants when used together. The highest percentage of explants that produced shoots and the number of shoots per explant were obtained from MS medium supplemented with 0.1 mg/L TDZ+0.5 mg/l BAP+0.1 mg/L IBA+0.3 mg/l GA_3. The highest rooting percentages were obtained on half-strength MS media supplemented with 2.0 mg/L IBA in jujube genotypes '20-C-10' and '20-C-22' (83.3 % and 80.0 %, respectively).

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Achievement of Green Manufacturing using Alternative Types of Cooling in Machining Processes

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Abstract: Machining is a process commonly used in the production of mechanical workpieces. Improving efficiency must be accompanied by environmental awareness with special emphasis on the social protection and labor. Higher values of the cutting parameters offer the possibility to achieve higher productivity, but at the same time present a risk of deterioration surface quality and tool life. Cutting fluids are used in metal machining for a variety of reasons such as improving tool life, reducing workpiece thermal deformation, improving surface finish and flushing away chips from the cutting zone. In order to increase the efficiency, there are incorporated some new parameters, such as environmental and social acceptability and greater economic profitability. More attention focused to the negative effects of the cooling and lubrication as well as the multiplication of these effects has led to the necessity of finding new solutions. Alternative types of cooling in combination with new materials for making tools and special coatings represent an area of finding appropriate replacement of the cooling and lubricating. The main focus of this paper is demonstration the capabilities and benefits of applying dry machining and alternativetypes of cooling in terms of reaching a better surface quality with longer tool life.

Keywords*:* green manufacturing; machining sustainability; cutting fluids; dry machining; alternative types of cooling; cooling with cold compressed air.

1. INTRODUCTION

The environment is closely linked with human civilization. Healthy environment is main criterion in order to ensure preservation of the human race. Nowadays, mankind is no less dependent on technology than nature. Technology has made lifestyles more pleasurable, but in many cases it has a great negative impact on the environment. In the early 1970s, public discussion of the consequences and measures necessary to conserve the environment has been stimulated by citizens, action groups, and parliamentary movements (Youssef & El-Hofy, 2008). All parties realized that if proper attention is not paid to the environment we will have to face a lot of health and survival problems. As a result, in the early 1980s they had integrated environmental protection into their political programs. Lastly, the global environmental problems caused by the consumption of natural resources and the pollution resulting from the life of technical products have led to increasing political pressure and stronger regulations and legislations being applied to both the manufacturers and users of such products (Jegatheesan, Liow, Shu, Kim, & Visvanathan, 2009). The restrictions resulting from such legislation pose a challenge to scientists and engineers to develop new and alternative manufacturing technologies.

As currently configured, manufacturing has a large material impact on economy and the environment. Manufacturing is responsible for around 35% of the global electricity use, over 20% of CO_2 emissions and over a quarter of primary resource extraction. Along with extractive industries and construction, manufacturing currently accounts for 23% of global employment. It also accounts for up to 17% of air pollution-related health damages. During this critical time, an advanced manufacturing mode called green manufacturing (GM) as become popular as a sustainable development strategy in industrial processes and products (Dixit, Sarma, & Davim, 2012). GM is a modern manufacturing strategy integrating all the issues of manufacturing with its ultimate goal of reducing and minimizing resource consumption and environmental impacts like waste and pollution, during a product life cycle.

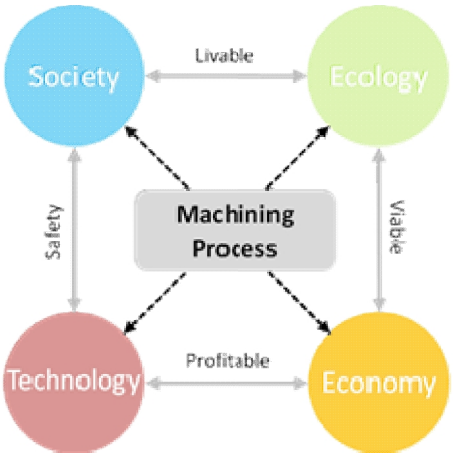

Figure 1. Sustainable machining process from GM point of view

One of the major manufacturing processes is machining process. Machining processes constitute a major manufacturing activity that contribute to the growth of the global economy. Research and development (R&D) in machining processes have, on one hand, improved machining performances through advanced tool materials, higher productivity, and quality, while on the other hand, environmentally and health-friendly technologies are becoming increasingly important for achieving cleaner, healthier, and safer machining (Westkamper, 2008). In considering a clean machining process, the interaction between society, economy, ecology and technology has to be considered, as shown in Figure 1.

2. CONVENTIONAL MACHINING

Machining is generally performed after other manufacturing processes such as casting, forging or bar drawing. Those processes create the general shape of the starting workpart, and machining provides the final geometry, dimensions, and finish. Conventional machining is a manufacturing process in which a sharp cutting tool is used to mechanically cut away material to achieve the desired geometry. The predominant cutting action in machining involves shear deformation of the work material to form a chip; as the chip is removed, a new surface is exposed. Higher values of the cutting parameters offer the possibility to achieve higher productivity, but at the same time present a risk of deterioration surface quality and tool life. Cutting fluids (CFs) are used during the machining of metals for a variety of reasons such as providing lubrication and cooling, improving tool life, reducing workpiece

thermal deformation, improving surface finish and flushing away chips from the cutting zone.

In early 1960s, researchers have begun to recognize and express concern about the impact of CFs on the environment and health of workers. Today's cutting fluids manufacturers are in the position that they must follow and abide by the rules and regulations of various governments about the impact of certain chemicals on the environment and a society. Manufacturers around the world currently use about 2.4 billion litres of CFs forming a significant demand for this type of non-renewable raw materials (Glen & Van Antwerpeen, 2004).

2.1. Economical aspects of CFs

Many studies bring consumption data in tonnes, costs in the billions of dollars which is evidence of the extent of cutting fluids usage and costs in amounts to 17% (Feng & Hattori, 2000). Some research determined that the 60% of the total energy required for the machining is used for cutting fluids supplying, which is a serious problem due to the continuing trend of growth in energy prices (Rahäuser, Pflüger & Regenfelder, 2011). In order to capture the real total cost of using CFs, which involves a process of procurement CFs, its storage, use, maintenance, collection, treatment and disposal, it is necessary to take into account all the stages in the life cycle of CFs with detailed costs of each. Bierma and Waterstraat in their studies have been measured the costs of the two components and the results showed that the ratio of the CFs cost and hidden costs (costs associated with use of CFs) are from 1.0 : 1.5 as well as up to 1.0 : 5.5 for some studies, favor of the hidden costs (Bierma & Waterstrat, 2004).

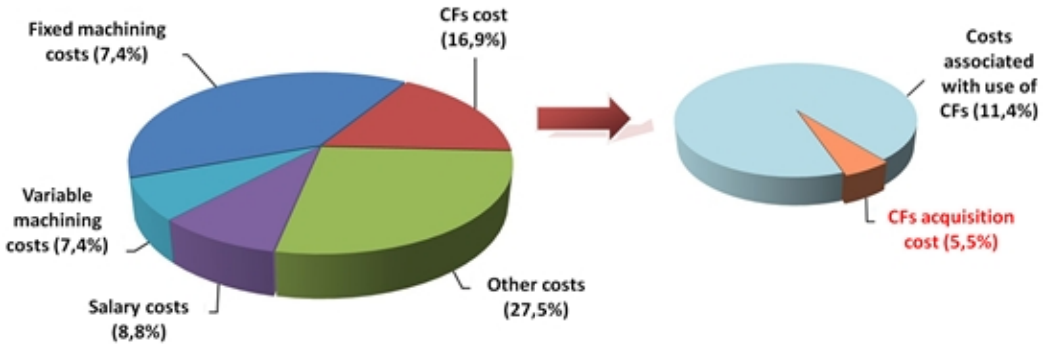

Figure 2. Overview of the total manufacturing costs and cutting fluids costs

2.2. Health hazards of CFs

Different terms to characterize the physico-chemical properties of a CFs like explosive, oxidize, extremely flammable, highly flammable and flammable, and the toxicity of CFs such as very toxic, toxic, dangerous, corrosive, irritant, carcinogenic indicate high the risk of adverse impacts of CFs on health when handling such assets. The U.S. National Institute of Health estimates that the annual state-level 1.2 million workers adversely affected by CFs. CFs has negative health effects on the workers that appear as dermatological, and malignant and nonmalignant respiratory, and pulmonary diseases. Those hazards associated with CFs using, present CFs as hot button issues with a number of potential short-and long-term consequences for humans (Dixit, Sarma, & Davim, 2012).

2.3. Environmental issues associated with CFs

The total amount of satisfactory disposed (removed) CFs is the amount of CFs recycled or incinerated as a fuel, and according to the data from the EU area, it is only 32% of total consumption, which is concerned (Mortier, Fox and Orszulik, 2010). Aforesaid, nearly 30% yearly used amount of CFs has been disposed from the production systems (Byrne, Dornfeld & Denkena, 2003). Storage and disposal of used cutting fluids raises many environmental issues especially since it is one of the most complex types of waste. Large amounts of nondisposed CFs in the area of Western Europe have forced EU in 2006. to adopt a regulation called REACH, i.e. Registration, Evaluation, Authorisation and Restriction of Chemicals. This regulation as a new EU legal framework for chemicals covers all types of CFs and all phases, from production via use to final disposal.

3. DRY MACHINING

Competitive cost pressures and increasingly stringent environmental and occupational health standards are inspiring current machining industry to seek ways to minimize or eliminate their use of cutting fluids. Dry machining is ecological desirable process of metal removal that does not involve the use of wet cutting fluids. The elimination of coolant also imposes the loos of its positive effects, namely lubrication, cooling and flushing. Consequently, the mechanical and thermal loads on the cutting tool are increased. This means that there is more

friction and adhesion between tool and workpiece. Therefore, cutting tool for dry machining applications can be designed in three different ways: by using new cutting tools material, by adapting new cutting tool geometries or by applaying special cutting tool coatings. Important factor affecting the choice of dry machining is the workpiece. Sometimes, a cutting fluid can stain the part or contaminate it. Consider a medical implant, such as a ball joint for a hip. Fluids are undesirable where there is the fear of contamination. A cutting fluid can be superfluous for cutting most alloys of cast iron, and carbon and alloyed steel, for example. These materials are relatively easy to machine and conduct heat well, allowing the chips to carry away most of the heat generated. The exception is low-carbon steel, which becomes more adhesive as the carbon content falls. These alloys might need a fluid as a lubricant to prevent welding. Cutting fluids normally are not necessary when machining most aluminum alloys because of the relatively low cutting temperatures. Machining stainless steels dry is a little more difficult. Heat can cause problems in these materials. Cutting fluids are mandatory for cutting titanium.

4. ALTERNATIVE TYPE OF COOLING

Advanced cutting tool materials, coatings and designs, along with different strategies for lubrication, cooling and chip removal, make it possible to achieve the same or better results with minimum quantity lubrication machining, cryogenic machining and air cooling or other viable alternative for liquid coolants: shorter cycle times, better surface finish, longer tool life, and higher recycling value for clean chips.

4.1. Minimum quantity of cooling and lubrication (MQCL)

In the machining of the above mentioned materials, an interesting option is the use a lubrication/coolant system based on the injection of pressurized air with small quantities of media. This technique is designated as minimum quantity of cooling and lubrication (MQCL). There are two type, minimum quantity cooling (MQC) and minimum quantity lubrication (MQL), depending on the type and on the main function of the fluid medium supplied. When oils are used as the fluid medium, the emphasis is on their good lubrication properties. Their function is to reduce friction and adhesion between the workpiece, the chip and the tool. As a result, the amount of friction heat generated is also reduced. Consequently, the tool and the workpiece are exposed to less heat than they would be if the machining operation was

performed completely dry (Aoyama 2002) However, the minimum quantity cooling technique can make a major contribution to the solution of thermal problems affecting the tool and/or the part in dry machining operations.

4.2. Cryogenic machining

Cryogenic machining relates to delivering a super cold medium to the cutting region of the cutting tool, which is exposed to the highest temperature during the machining process, or to the part in order to change the material characteristics and improve machining performance. The coolant is usually nitrogen fluid which is liquefied by cooling to 196°C (liquid nitrogen). As most cryogenic coolants used in machining operations such as liquid nitrogen and liquid helium are made from air, they are not considered as pollutants for the atmosphere. Nitrogen in particular is an inert gas which forms 78% of the atmosphere and is lighter than air. As a result it is dispersed into the atmosphere and does not harm the workers on the shop floor.

4.3. Air cooling

Employing compressed cold air for cooling in machining operations is a relatively new technique which has attracted many researchers. A vortex tube is a device which produces cold and hot air from compressed air, Figure 3. As in this technique the cooling media is air, it could be defined as the cleanest and most environmentally friendly method of cooling in cutting operations.

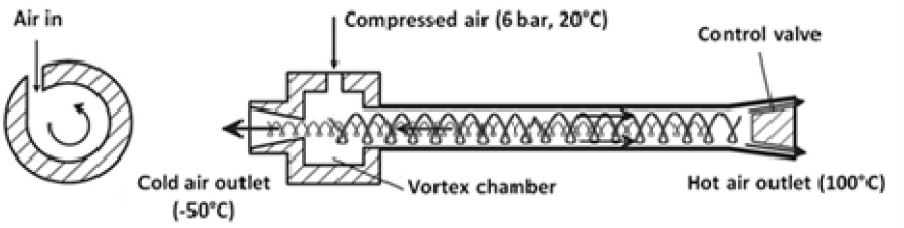

Figure 3. Separation of a compressed air into a hot stream and a cold stream

Most studies indicated that using chilled air as coolant in machining resulted in longer tool life (Sun, Brandt & Dargusch, 2010). The effect of chilled air on the surface finish is highly dependent on the machining parameters. In general it could be claimed that air cooling produces lower surface roughness than dry cutting.

5. RESULTS AND DISCUSSION

Reviewing of the factors shown in Table 1., choice of alternative types of cooling in the form of compressed cold air cooling would mean a relatively small investment cost and application, almost no maintenance requirements with maximum fulfillment of sustainability terms. However, the efficiency of the process in terms of tool life, the quality of the machined surface, the possible selection of relatively lower (milder) cutting parameters, the material removal amount, the cost of the process, it is lower in some cases compared to the MQL technique and cryogenic cooling procedures. However, the selection of an alternate type of cooling creates opportunities in comparison with conventional cooling methods for the investigation purposes of the process sustainability

Table 1. Influence factors for choosing a particular alternative type of cooling

Alternative type of cooling	Investment cost	Application cost	Maintenance necessarity	Technique efficiency	Achievement of sustainability terms		
					economical	ecological	social
MQL	H	H	H	M	H	M	M
Cryogenic machining	H	H	H	H	H	H	M
Compressed cold air cooling	L	L	L	M	H	H	H

L – low, **M** – medium, **H** – high

The type of machine used for the milling test was machining center VC 560 manufactured by Spinner. Test sample used in experiment were made of steel 42CrMo4 with dimensions 100x250x100 mm. The end milling experiments were executed by a tool CoroMill 390 with three TiN coated inserts, produced by Sandvik. Average surface roughness *Ra* of machined workpieces was periodically measured by a Surftest SJ-301, produced by Mitutoyo.

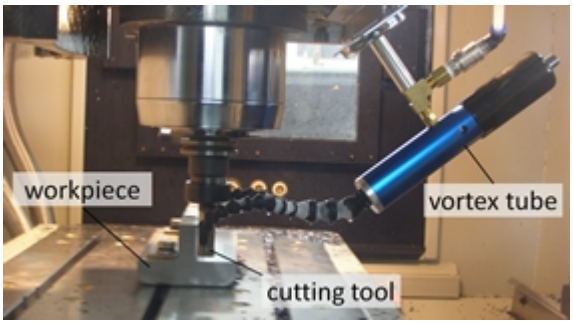

Figure 4. End milling process with alternative type of cooling, compressed cold air

In figure 4 is shown position of a cold air gun in machining process. Figure 5 shows surface roughness values for three types of machining specified as dry machining, air cooling and CFs machining.

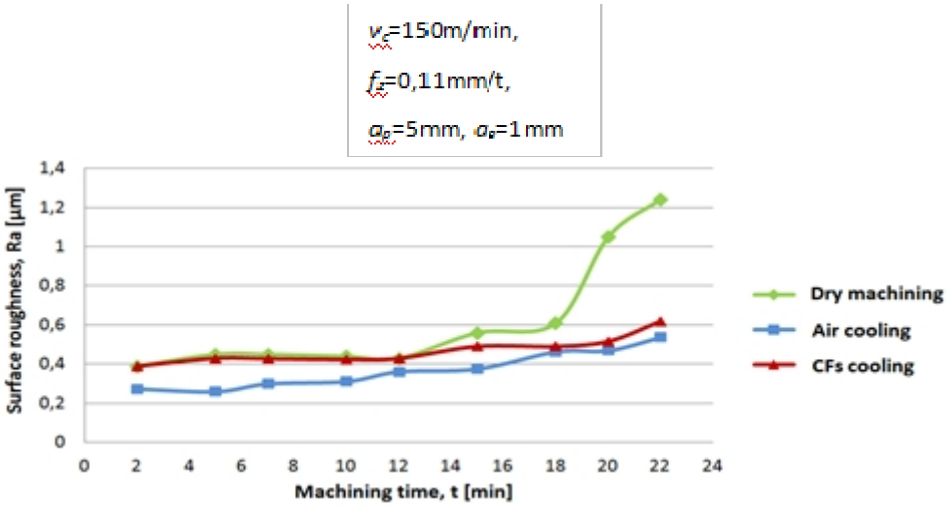

Figure 5. Graphical representation of the experimental results

Application of cooling with cold compressed air has two positive features. The first one is reaching a minimum value of surface roughness, and the other one is that the tool wear is delayed what is not the case for dry milling, because tool wear affects the increase in surface roughness.

6. CONCLUSION

This paper gives an overview of the machining process with the respect to the sustainability manufacturing. There are emphasis on the impact of machining process on the environment, health and economic conditions. The CFs viewed from three different aspects such as ecological, economical and sociological, represents a big challenge to scientists in their looking for better solutions in the field of cooling and lubrication in the machining, which will be technically and economically competitive and will not be a threat to the future, or to the sustainability machining. According to the theoretical study there is a great potential in replacing the traditional ways of cutting fluids applications in terms of shorter cycle times, better surface finish, longer tool life, and higher recycling value for clean chips. Alternative types of cooling in combination with new materials for making tools and special coatings represent an area of future research.

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General Tool Conditions for Green Machining

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Abstract: The development of "green" machine tools will require novel approaches for design, production and operation for energy savings and reduced environmental impact. Manufacturing processes carried out on machine tools are energy intensive. As machine tools have become more advanced, their degree of automation has risen by adding components such as tool change mechanisms or additional axes. Given the general trend of increasing power demand of machine tools the cost that companies have to expend on electrical energy will rise in the future. Furthermore, the external costs on the environment rise, since currently the majority of electrical power is obtained from burning fosil resources. A foreseeable shortage of fossil resources and a growing demand to include the external cost of environmental damage in product prices are likely to increase the cost of electrical energy for companies even further. Therefore, in order to maintain competitiveness and lower costs, companies have to identify ways to decrease the energy consumed during manufacturing for a given product.

Keywords: green machining; depth of cut (doc); diamond tools; tool conditions; cnc lathes

1. INTRODUCTION

The machining of a ceramic in the unfired state is called green machining. Green machining of ceramics is done whenever possible since the machining of ceramics after firing is very costly. The machining centers found in our plant are very similar to those found in standard machine shops; CNC mills, and CNC lathes drilling equipment, cut-off saws, surface grinders, rotary grinders, as well as many machines that have been custom made in-house. However, the extremely abrasive nature of ceramics requires the use of carbide and PCD tools and abrasive wheels (Diaz, Choi & Dornfeld, 2010).

CVD diamond tools are a perfect match for machining unfired aluminum oxide, tungsten cabide, silicon carbide, and other green ceramics. The abrasive nature of these materials severely limits the life of carbide tools, and PCD diamond tools are not available in the small, multi-flute configurations required for machining fine detail. Tools with diamond on the surface wear longer and have a lower coefficient of friction. These characteristics provide substantial benefit to the machining operation. Because diamond tools last much longer—10 to 50 times the life of carbide—they:
– Improve the dimensional accuracy and consistency of the machined parts
– Greatly reduce the number of tool changes, increasing productivity
– Increase machine utilization
– Allow much longer periods of unattended machining, e.g., overnight
– Quickly pay for themselves

The low friction of CVD diamond tools permits using speeds 2 to 3 times higher than carbide—again contributing to productivity—with no degradation of surface quality. The consistently sharp edge and low friction allows delicate, thin-wall sections to be machined quickly and precisely at high rpm settings with reduced feed rates.

2. MATERIALS AND METHODS

A major manufacturer of ceramic components for the semiconductor industry had a problem making a gas diffusion furnace component with 24 slots cut at an angle through the full depth of the part. Machining this part with uncoated carbide 3/8"

endmills typically required 10 tools to complete one part. While the entire milling operation— about 11/2 hours—ran under CNC control, the machinist had to watch continuously for the onset of chipping as a tool wore out, since chipping or cracking would invalidate the part—an expensive throwaway, especially if the part was almost fully machined (Meyers, 1964).

A manufacturer of precision ceramic parts for semiconductor, electronics, and medical device production switched to diamond tools to reduce tool change downtime. Inserts are used for turning alumina billets, then endmills and drills are employed for machining fine detail to tolerances on the order of 0.005". For a typical job using a 0.200" diameter endmill, two parts can be machined with carbide—vs. 800 parts with the diamond tool. Savings in downtime for tool resharpening or replacement in this and other operations has allowed parts to be made that would have been unprofitable with carbide tools. In this application the diamond tools are run at speeds and feeds about 15% higher than carbide (Figure 1).

2.1. The green ceramic cutting process

In any machining process, a wear-resistant cutting edge separates material from the workpiece because of the velocity of the cutting tool edge relative to the workpiece. When cutting metals, intense heat causes plastic deformation, producing chips or a curl of material. Green ceramic is different; it is machined by a process of fracturing the material rather than a plastic deformation. The cutting edge crushes the ceramic just ahead of the tool edge as it moves through the material. This forms small particles, resulting in ceramic powder as an end product rather than chips or a curl, as when cutting metal. The ceramic cuttingprocessdoesnotgenerate hightemperatures. Attention must be paid to the avoidance of chipping at the edge of a workpiece and development of internal cracking caused by compressive stresses (Young, Omatete & Janney, 1991).

Figure 1. In turning soft alumina, diamond inserts last almost indefinitely.

When cutting metals, the intense heat that is generated results in tool wear increasing rapidly with increase in cutting speed. The absence of elevated temperatures when machining green ceramic essentially eliminates speed as a contributor to tool wear.

Because small feeds and depths of cut do not lead to increasing the crushing effect on green ceramic, tool wear will advance rapidly with light feed, but stabilize as feed is increased. As the cutting action moves toward producing larger cracks and particles of removed material, flank wear of the cutting tool edge stabilizes. Therefore, in addition to increasing the volume of material removed, increasing feed can extend tool life. The depth of cut should not exceed one-third of the tool diameter. Increasing the depth of cut to one-half the tool diameter will.

The residue frommachining green ceramic will range from small particles (0.001" – 0.005") to fine dust. Adust collection system employing high velocity air is commonly used. A minimum air velocity of 500 ft/min is needed to capture the dust at the machining location. After capturing the dust an even higher velocity of 2000 ft/min should be used to prevent dust from settling in the exhaust ducts. Screening should be used in advance of the dust filters to catch large particles which might damage the filter system. The primary precaution is to avoid excessive clamping pressure. While the composition of green ceramics can range from “fairly

strong" to "very soft", all workpieces must be viewed and treated as easily crushable. Unlike metals (aluminums, coppers, etc.) which can take on permanent warpage and deformation, green ceramic will fracture, especially parts with thin walls, and rods with a high length/diameter ratio. Vacuum chucks and fixtures are the preferred method of holding workpieces. Vacuum works well for normal forces; for lateral forces a mechanical stop is required (Dahmus & Gutowski, 2004).

Mechanical stops and clamps should be cushioned using PVC electrical tape. Neoprene should not be used as a cushioning or gripping material because it is too soft, resulting in vibration of the workpiece. For turning, "pot" chucks made of a compressible material such as Delrin or Nylatron work well. The workpiece is inserted in the chuck's recess, and the chuck is then held and compressed in a conventional 6-jaw mechanical chuck. The pressure of the jaws compresses the pot chuck so as to grip the ceramic workpiece. To prevent slippage, the green ceramic should be wrapped in emery cloth, with the abrasive surface on the outside and double-sided adhesive tape between the emery cloth and the workpiece. Minimize clamping pressure, relying on vacuum retention and methods such as emery cloth to prevent slipping (Trent, 1991).

2.2. Endmilling, drilling and profiling green ceramic

Use square endmills with a small radius whenever possible. Diamond tools are more brittle than carbide and sharp corners may break upon entry into a cut at high feed rates. A radius of 0.010" to 0.015" will greatly strengthen the tool, providing extra durability. For roughing at high feed rates 2-flute endmills should be used to minimize the possibility of tool breakage fromflute packing. For general purpose and finish cutting use 4 flutes; the cost for a CVD diamond endmill is the same, regardless of flute count. Improved surface finish and longer life usually result from multiple flutes in finishing operations.

Starting conditions for milling vary considerably for green ceramic, but generally 200 sfm and 0.002 inches per flute per revolution is a conservative starting point for 1/4" diameter and larger endmills. The table details recommended starting parameters.

The table shows starting machining parameters for drilling green ceramic. These conditions will vary according to the grade of ceramic being machined and the set-up and dust removal practices (Table 1).

Table 1. Starting parameters for drilling green ceramic

Drill diameter inches (mm)	**Peck size** inches (mm)	**Cutting speed** sfm (m/min)	**Feed rate** ipr (mm/rev)
1/32–3/16 (1.0–5.0)	1/128–3/64 (0.25–1.25)		.001–.003 (.025–.075
3/16–1/4 (5.0–6.0)	3/64–1/16 (1.25–1.5)		.002–.004 (.025–.100)
1/4–5/16 (6.0–8.0)	1/16–5/64 (1.5–2.0)	200-1000 (60-300)	9.002–.005 (.025–.130)
5/16–3/8 (8.0–10.0)	5/64–3/32 (2.0–2.5)		.002–.006 (.025–.150)
3/8–1/2 (10.00–12.0)	3/32–1/8 (2.5–3.0)		.002–.008 (.025–.200)

2.3. Turning and milling green ceramic with inserted cutters

Disposable inserts with a 1/64" to 1/32" nose radius are most effectively used for turning and milling green ceramic. Apositive rake insert with a ground flank is preferred. Finish can be improved by selecting the appropriate tool geometry and feed rates. Larger nose radii will improve finish, but with increased tool pressure. A smaller nose radius will relieve pressure, but feed must be reduced to achieve comparable surface finish. DOC will not affect surface finish unless it causes excess tool pressure resulting in vibration, or if it is too light (under 0.005") to remove an adequate amount of material.

Breakout at the end of a pass is always a concern. This can be avoided by having a chamfer cut at the end of the part to ease exit of the tool, or provide stock which can later be cut off. Avoid square-nosed cut-off tools to prevent breaking prior to completion of the cut. A 20° relief angle is recommended.

When machining long rods and cylinders, higher speeds and depths of cut can be employed with higher strength materials.

The following starting parameters are recommended for general purpose and finish turning. When milling large surfaces or volumes, higher speeds and depths of cut can be employed. Use higher strength materials when there are thin walls involved (Table 2).

Table 2. Starting parameters for turning green ceramic

Operation	Cutting speed sfm (m/min)	Feed rate ipr (mm/rev)
General purpose Finish	100–500 (30–150)	.002–.010 (.050–.250)

DOC should always be maximized when possible, to reduce multiple passes. Lower feed rates will allow holding deeper cuts. Feed rates of 0.004"/tooth/revolution for roughing and between 0.0005" and 0.002"/tooth/revolution for finishing might be necessary.

For multiple-pocket milling cutters it is recommended that axial alignment be used to align all inserts within ±0.0002" for best results. This will improve surface finish and reduce insert wear, as all the inserts will be cutting equally.
The following starting parameters are recommended for general purpose and finish milling (Table 3).

Table 3. Starting parameters for milling green ceramic

Operation	Cutting speed sfm	Feed rate in/tooth (mm/tooth)
General purpose Finish	500–1000 (150–300)	.002–.006 (.050–.150)

3. RESULTS AND DISCUSSION

Green machining in the more demanding interrupted cutting environment calls for a tougher grade of hard tool material. For this, the solution can be selection of plain cemented carbide, K-type grade of tools. However, the application of such tools can be with only a lower order of cutting speeds, the limitation being due to cutting

temperature. In order to overcome this, one can make use of K-type coated cemented carbide tools.
Ultra-hard tool materials such as diamond and cubic boron nitride (CBN) cutters have been found to produce better machined surface characteristics, with considerable increase in tool life due to their higher hardness and thermal conductivity. Diamond and CBN, being super-hard materials, have found numerous applications as cutting tools. Diamond and CBN are very similar in many ways. They share the same crystallographic structure and exhibit high values of thermal conductivity. However, diamond oxidises in air and is subjected to graphitisation, loosing its form stability, thus limiting its application to relatively lower temperature situations.

The quality of a machined surface, especially in turning, depends largely on the form stability of the cutting tools. During turning, the cutting tool replicates its nose on the work surface, resulting in the formation of the surface texture (Figure 2). From the surface texture point of view, an ideal tool is one that is able to sustain the replication of the cutting nose. Hence, the performance of the tool or the quality of the machined surface texture is largely dependent on the form stability of the cutting tool. Form stability is largely influenced by the different forms of tool wear. The quality of a machined surface is important whilst evaluating the reliability and functional life of a structure. In addition, inappropriate selection of a tool material can result not only in surface deterioration but also in increase the tooling costs. Therefore, knowledge of cutting tool materials and the nature and quality of the surface that they produce is of considerable importance (Sreejith & Ngoi, 2000).

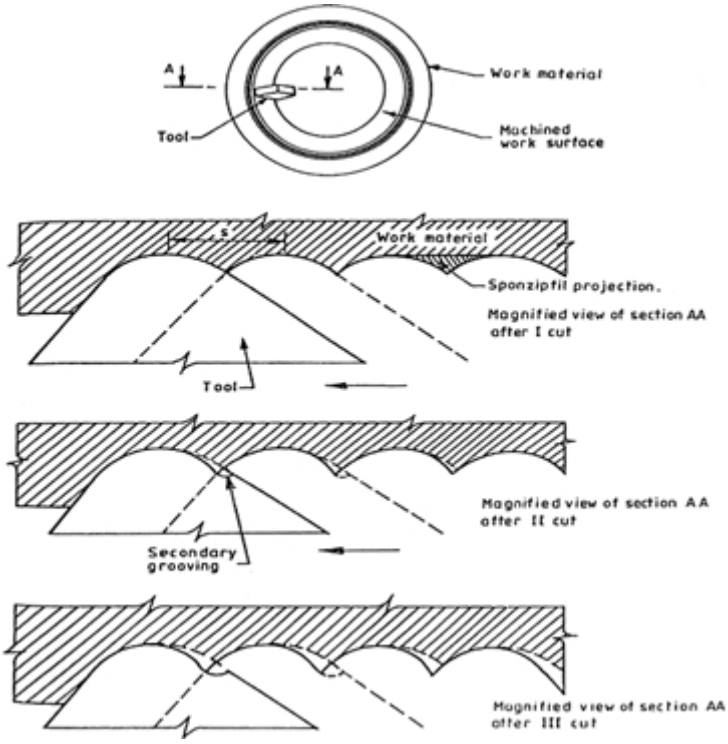

Figure 2. Typical illustration of surface production in machining. (Santhanakrishnan, 1994)

For achieving the desired results in machining, one has to be well informed regarding both the work material and the cutting tools. The tools used for dry machining have to suit some specific requirements. The options available under these include the following:

1. The use of very high positive rake angles (30°) on submicron cemented carbide tools, which will reduce the overall cutting energy significantly.
2. The development of refractory-type tool materials that can withstand high temperatures.
3. The use of ultra-hard tool materials such as diamond and CBN.
4. The development of coatings on tools that can withstand high temperatures and at the same time provide a lubricating effect to reduce friction.

4. CONCLUSION

1. The Green Machine is a machine that is able to unsure a green process.
2. The high performance machine can be also a green machine (reduction of cycle time) if the development is done taking into account the Eco-Evaluation.
3. There is a drastical difference in the spent effort among the different cutting processes: in the future it is expected high improvement in the processes not yet optimized.
4. For the other, only radical innovation in the technology-process chain can improve the eco impact.

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Innovation and Research&Development Perspective of SMEs in Turkey

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Abstract: Small and Medium-sized Enterprises (SMEs) in Turkey similar to all countries, holds largest share of the economy. It should be considered together with all the functions affecting these enterprises, in order to ensure them successful in competitive markets. New technologies, new competitors, reduced profit margins, etc. reasons adversely affect revenues of the enterprises. In this case, enterprises are required to activate new factors to stay afloat. Today, one of the most important factor of competition is innovation and technological development. The number of SMEs has reached 255 thousand in Turkey and these enteprises have 75% of total employment, 65% of total production capacity . In addition to economic and cultural characteristics of these enterprises, their perception to innovation and R&D(research and develoment) should be examined as well. Aim of this study to assess the perspectives of SMEs in Turkey to technological innovation and R&D. The study examined enterprises that give importance to technological innovation. It is seen from the the studies cited in this study that the SMEs are aware of the importance of innovation to survive competitive market conditions. However, cited studies show that SMEs in Turkey are insufficient in terms of innovation culture and technology management.

Keywords: ınnovation, research and development, smes in turkey, new production design

1. INTRODUCTION

Today, there are serious developments in economical, social, culturel, political and scientific areas and people have to keep harmony with these developments (Kılıçer, 2011).

In a world that continuously changes and develops, it became an obligation to chime this development process for the companies that aim to survive in their market. The companies that notice this reality, had the continuous evolution as a guide for themselves and decided to use current management approaches such as information and inovation management (Öztürk, 2009).

World's trade volume has expanded a great deal by courtesy of globalization that requires the removal of borders, convergence of countries economic structures and legal systems, the removal of protectionism trend on trade, and world has become an open market for companies. In parallel with these conditions, the number of exporting countries and the number of expoted products have increased and consumption patterns have became similar in many parts of the world. By the increase of the number of the countries that export a large number of similar products in the international markets, the concept of international competition has arised. Maintaining the competitiveness of both national and international markets, requires designing new products that fit the changing needs and providing competitive conditons to these products in their markets (Aksoy & Demirel, 2008).

In order to survive in a rapidly changing competitive environment, companies must alter and renew their services, production methods and products continuously. New or improved products, services, or production methods are born from new ideas. Innovation is a continuous activity, thus the ideas that were proposed and developed to increase the companies competitive power and possible results of these inovative ideas, must be evaluated over and over again and must be generalized for new returns (Bozkurt & Taşçıoğlu, 2007).

In a competing world, the importance of small and medium-sized enterprises becomes an increasing concept gradually. Then, the importance of the role of SMEs in economic growth has increased because of their ratio in the total enterprise quentity of the world over 90 percent. Economic and social role of SMEs about creating new employment opportunities and in regional and local development,

increases the importance of SMEs and young entrepreneurs. Because it directly affects the success of a country, SMEs must adapt to the developing new world and have the power to compete in the market, and most importantly, should be innovative. Due to the rapid decision-making and implementation, production flexibility, and lack of the bureaucracy, SMEs are capable of finding and implementing the innovations more easy than large enterprises (Yenginol, 2002).

2. R&D AND INOVATION

Global competition is accelerating day by day and the production is the most important action of a country in order to move forward in the global market. By courtesy of production, a country not only can increase its exporting but also can solve one of the most important the present-day problem such as employment. Today, countries and companies aim to make a difference with quite a lot of variety of products and services, and also aim to put forward and innovations in order to pass a step forward in this race. In this conditions, even a small value-added of manufacturers will ensure a positive gains by growing avalanche-like. In order to provide this value-added, today highlights two concepts: R&D and Innovation (Erkek, 2011).

R&D activities are executed in areas where there is scientific or technological uncertainty. In some of the R&D activities, aim is to develop or improve new product or to provide the scientific background to improvements. R&D is to allocate resources to researches in order to produce an existing product with more efficient and cheaper ways or to allocate resources for a product that was not manufactured and planned to be produced in the future, to be a pioneer in market (Türkiye 2. Bilişim şurası ARGE çalışma raporu, 2002).

In recent years, increasing competitive environment in national and international markets, requires for companies and countries to adapt to this environment by changing and developing their products, services and production methods constantly. "Innovation" is called as the change and renewal process implemented by companies and countries (Erkek, 2011).

In the literature, the concept of innovationhas become synonymous with J. Schumpeter. In the narrow sense, Schumpeter defined the innovation as to develop

a new production function. According to Schumpeter, innovation includes the activities such as inventing a new product and developing a new method of production and establish a new market, and develop new sources for the supply of raw materials or semi-finished products, and aim to create of monopoly by creating a new organization in any industry. However, the concepts of innovation and invention are different from each other. Invent is the development of an idea for a new product or production method for the first time. Innovation is firstly to commercialize an idea. However, the close relationship between invention and innovation is sometimes make it difficult to distinguish one from the other (Işık & Kılınç, 2011).

According to the OECD literature, innovation is to convert an idea to a process or a marketable product or service, a new or improved production or delivery method, or a new social service method. In his mind, innovation is function of entrepreneurship. Innovation is creating new sources of affluence creation or use of existing resources to increase the potential for the creation of affluence by entrepreneurs (Bozkurt & Taşçıoğlu, 2007).

R&D and innovation aim to identify especially the needs and problems of today's consumers of companies and countries, then carry out researches and supply new products or services in this direction. Accordingly, a unprecedented product or service, or improved version of an existing product or service, is obtained. This new product/service will attract the attention of consumers with its difference, will increase import, will bring profit, will increase the competitive power of the company and employment in the country (Erkek, 2011).

R&D and innovation are at the top of the last 10 years in the countries economy and industry policies. Governments are supported R&D and innovation incentives, even in times of crisis, in order to provide high percentage production and export. R & D and innovation are carried out by private enterprises, public institutions, non-profit institutions, and universities. At this point, the R&D investments of countries have great importance and related with several branches of a country's economy. Countries that have carried out large amounts of R&D investments for many years made great strides in the field of science and technology and today they reinforced their competitiveness concerning industry and production in the global market (Erkek, 2011).

3. SMES AND İNOVATİON IN SMES

Since the 1990s, the concept of SME was began to use frequently, but it could not be said taht all the institutions agreed to a single definition. In order to determine the size of enterprises for many years different institutions have used different criteria. Different state-owned enterprises even have done diffrent definitions addition to international definitions. Because these differences in definitions, set incentives for enterprises, every organization has developed its own appropriate definition. This situation has created a conceptual confusion (Yıldız, 2010).

Socioeconomic status, level of industrialization, technology, market size, business area that carried out, the technique used in the production, manufactured goods characteristics, the amount of labor employed in the organization, research types carried out in the organization affect the definition of SMEs (Erol, 2010).

According to the definition of SMEs that was published in the Official Newspaper dated with 18.11.2005 and numbered with 25997, it was intended to render a regulation on the classification of enterprises in Turkey, according to their size. According to this regulation, the classification of small and medium-sized enterprises is determined with three categories such as micro-enterprises, small enterprises and medium-sized enterprise (Yıldız, 2010).

Accordingly, Table 1 can be obtained regarding to the main criteria used in the SMEs definitions such as the number of employees, annual net sales proceeds and annual financial balance sheet. A definition of SMEs in Turkey has been made compatible with the EU(european union) in terms of the number of the employee. However, turnover and capital structure of enterprises in Turkey is smaller than EU enterprises, thus economical definitions were determined below the adopted values in the EU SME definition (Yıldız, 2010).

Table 1. EU(european union) and Turkey SMEs definitions (Yıldız, 2010).

EU(european union) definition criteria	**Micro**	**Small**	**Medium**
Number of employees	< = 10	< = 50	< = 250
Annual net sales proceeds	< = 2 million euro	< = 10 million euro	< = 50 million euro
Annual financial balance	< = 2 million euro	< = 10 million euro	< = 43 million euro
Turkey definition criteria	**Micro**	**Small**	**Medium**
Number of employees	0-9	10-49	50-249
Annual net sales proceeds	< = 1 million TL(425000 euro)	< = 5 million TL(2125000 euro)	< = 25 million TL(10625000 euro)
Annual financial balance	< = 1 million TL(425000 euro)	< = 5 million TL(425000 euro)	< = 25 million TL(425000 euro)

According to 2009 Annual Business Statistics data from TUİK(Turkish Statistical Agency), sector-based distribution of all enterprises is given in Table 2. Accordingly, 99.9% of total enterprises are SMEs. Micro-enterprises with 1-9 employees are 95.62% of the total enterprises. 82% of SMEs are in the service and commerce sectors, and 13% of SMEs are the manufacturing sector (2011-2013 SMEs Strategy and Action Plan).

Table 2. The distribution of initiatives according to their sector and the quantity of employees (2011-2013 SMEs Strategy and Action Plan).

SECTOR			The number of enterprise employees 1-9	The number of enterprise employees 10-49	The number of enterprise employees 50-249	The number of enterprise employees 250+
C		Mining and Quarrying	4,326	994	301	63
D		Manufacturing	364,513	33,152	6,827	1,381
E		Generation of Electricity, gas, steam and hot water	1,545	204	71	47
F		Construction	147,041	16,596	2	250
G		Wholesale and retail trade, motor vehicles, motorcycles repair of personal and household goods	1.242.625	35,897	2,448	345
SERVICE	H	Hotels and restaurants	253,861	6,939	876	191
	I	Transport, storage and communication	550,884	7,398	714	161
	J	Financial intermediation	49,642	1,315	123	62
	K	Real estate, renting and business activities	209,366	7,854	1,578	529
	M	Education	8,179	4,185	502	91
	N	Health care and social services	42,536	2,817	381	85
	O	Other community, social, and personal service activities	209,665	4,395	383	124
Total			**3.084.183**	**121,746**	**16,204**	**3,329**
The distribution of enterprises according to the scales			**95,62%**	**3,78%**	**0,50%**	**0,10%**
Distribution in accordance with the scales in the EU 27 (average)			**91,80%**	**6,40%**	**1,10%**	**0,20%**

SMEs in Turkey constitutes 78% of total employment 55% of total value added, 65.5% of total sales , 50% of total investments, 56% of total exports. The share of SME loans in total loans was 23% (2011-2013 SMEs Strategy and Action Plan).
So globalization, economic and social changes, decrease in product life expectancy, increasing technological capacities, and resulting competition and customer needs makes innovation very important in SMEs which have largest share the economy of our country. SMEs, assumed an important function in the development of countries, are considered as balance of system, main insurance of democratic society and a free market economy. As it is for all businesses, As it is for all businesses, innovation is a crucial condition to survive in the competitive environment for SMEs. Innovation is acceptance of new idea, product, or process. The idea of innovation is a broader concept than invention. SMEs, in order to maintain their situation in competitive environment, have to give prominence to innovation. Through an innovation strategy, SMEs, can achieve a competitive advantage in the global era (Aksoy & Demirel, 2008).

According to a study carried out by Brown in 1994, causes of SMEs to innovate are explained with 3 reasons (Öztürk, 2009);
1.They may have to be innovative to respond to innovation in a competitive environment,
2. They may think to gain advantage by taking the attitude of attack or industry may redirect them to use of new technology
3. They may be innovative in order to prevent others inovation who damage their business.
Results of this study are compatible with a study conducted in 2008 in Elazığ. A. Aksoy and E.Demirel performed a study in order to determine perspectives of innovation activities of SMEs in Elazığ. Several questions were asked to 65 units SME about innovation through a questionnaire. Almost in every study the basic purpose was supposed as keeping the competing power, and new purposes that will occure, were thought as the complementary of this basic purpose. The results of the research about innovation purposes are given in Table 3 (Aksoy & Demirel, 2008).

Table 3. Perspectives on Innovation Activities of SMEs in Elazig (Aksoy & Demirel, 2008).

Expressions	Level of Significance											
	1		2		3		4		5		TOTAL	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Innovation is the most effective way to maintain the competing power	-	-	-	-	-	-	28	50	28	50	56	100
Customers are demanding for innovation	14	25	7	12,5	7	12,5	21	37,5	7	12,5	56	100
Add the new ones to existing products	14	25	-	-	-	-	21	37,5	21	37,5	56	100
To maintain and enhance market share	-	-	-	-	7	12,5	-	-	49	87,5	56	100
Find new markets	-	-	-	-	7	12,5	21	37,5	28	50	56	100
Develop the product	-	-	-	-	-	-	28	50	28	50	56	100

The mean of expression "innovation is the most effective way to maintain the competing power" is 4,50. Opinion, supports this conclusion, İnnovation is the most important competitive tool, can be considered as an indication that awareness of innovation. This result exactly coincide with 1. item of study carried out by Brown. Perception that the most important competitive tool is innovation has not changed over the years.

The mean of expression "customers are demanding for innovation " is 3. According to today's marketing concept based on customer requirements, that was expected customer demand was one of the most important sources for innovation. But the average was 3, and it showed that the importance given to customer demand was low.

The mean of expression " add the new ones to existing products" is 3.63. Adding new products to existing products, may be accepet to be contribution to competitive advantage.

The mean of expression "To maintain and enhance market share" is 4.75. This purpose is one of the objectives that contribute to the purpose of providing competitive advantage too.

The mean of expression “find new markets” is 4.38. Try to enter a market not shown activity previously though innovation, in other words being a pioneer, is sign of beginning added to the success column of SME. However,according the study results, the mean of expression "To maintain and enhance market share" is higher than the mean of expression “find new markets”. This situation is indicative of behaving timidly about new markets. The mean of expression “develop the product” is 4.50. This expression means that “develop existing products” or “produce products containing radical changes” is just one of the alternatives of business about innovation. As can be seen, according to the results of the two study, the main reason for innovation In SMEs is to survive in the competitive environment. However, studies show that SMEs in Turkey are insufficient about culture of innovation and technology management skills (Aksoy & Demirel, 2008). Rates of enterprises carrying out technological innovation activities according to the sector and the scale are given in Table 3. The highest rate of sector carrying out technological innovation is manufacturing sector with %34.7. While 48.6% of large-scale enterprises were emphasizing that carried out technological innovation activities, between 2006 – 2008 years,this rate remained at %27,8’de small-scale enterprises. Rate of enterprises financial supporting for technological innovation is at the level of 23-27% and does not change according to the enterprises scale (2011-2013 SMEs Strategy and Action Plan).

Table 3. Rates of business carrying out technological innovation activities according to the sector and the scale (2011-2013 SMEs Strategy and Action Plan)

Sector	Rates of enterprises carrying out technological innovation activities according to the sector and the scale (%)	Rate of enterprises financial supporting for technological (%)
Mining (C)	22,7	21,1
Manifacturing(D)	34,7	30,1
Energy (E)	17,8	23,1
Wholesale Trade	24,5	12,2
Service(G-O)	23,2	12,3
Scale		
Small (10-49 employee)	27,8	23,7
Medium(50-249 employee)	38,4	27,9
Large (250+ employee)	48,6	23,7

Despite various problems, we can see that there is idea of innovation in SMEs in Turkey although not the professional stage. In the study conducted by A. Aksoy and E. Demirel (2008) in Elazig, asked various questions to determine how much took part the idea of innovation on the agenda of SMEs.The obtained results are present in Table 4.

According to the table, the idea of innovation is on the agenda of the enterprises, almost all of the ideas put forward were negotiable, some of the ideas discussed could not be realized due to various constraints, half of the ideas can be applied converted into outputs that have economic value (Aksoy & Demirel, 2008).
In a similar study made in Trabzon SMEs, were asked questions about the application of SMEs innovation through a questionnaire. Businesses, taking into account the scale scores were categorized according to their innovation practices ownership. Accordingly, at the more than half of enterprises in research (62.5%) had the innovation management. For Trabzon, this number is quite good (Öztürk, 2009).

Table 4. Discussed Innovation Ideas (Aksoy & Demirel, 2008).

	Answers				Total	
	Yes		No			
	Number	%	Number	%	Number	%
Have the any inonovation idea was launched your enterprise in the last 5 years?	49	87,5	7	12,5	56	100
If idea of innovation was launched,have it was discussed?	49	87,5	7	12,5	56	100
If there has been an idea discussed, have you thought to put into practice?	35	62,5	21	37,5	56	100
If there has been an idea put into, economic value was obtained from an output?	28	50	28	50	56	100

4. RESULTS

SMEs are economic units that are spread to Turkish economy almost with %99 rate. Thus, SMEs trigger and form the economic orders. In today's world, national boundaries term lost its significance because of globalization. Along with globalization process, the manufactured product is more important than the size of enterprise.

Competition between businesses has become important and intense in the market owing to speedily progressing technology and gaining innovation to our lives. In this age changes process is very fast. So SMEs which are the most dynamic factor in the today's economy should follow closely inovations and pioneer the change to apply them. Researches show that although SMEs has flexible structure and less strict bureaucracy they can't adapt to change. The research works which were studied by Aksoy&Demirel in 2008 demonstrate that SMEs are aware of how important innovation to survive in the competition environment. To be conscious in this issue is quite pleasing.

It is thought-provoking that 48.6% of large-scale enterprises were emphasizing that carried out technological innovation activities, between 2006-2008 years,this rate remained at %27,8'de small-scale enterprises. In the globalizing world if say "we are

also here", SMEs must increase innovation rate. According to research SMEs have difficulty to employ qualified personnel on research and development (R&D) and innovation field. So SMEs remain incapable to reach technologic information and pursue technologic innovation. Research works which are carried out in Elazığ and Trabzon indicate that SMEs are eager about innovation issue and they keep it on the agenda. But some of SMEs are unqualified for converting innovation ideas to product because of inadequate financial recourses. In order to overcome this situation, Technology Centers, supports for innovation and EU programs provide such opportinuties as tax credits, patent databases, the Enterprise Europe Network Centers. However, the study has shown that on SMEs operating in Izmir, these opportinuties inadequately known. If these opportunities are conveyed adequately to SMEs, innovation rates across the country could be increased.

5. SUGGESTIONS

Although a large number of theoretical studies, there is not any accpepted recipe that we can say "if we follow step by step, we are innovative". However, some important common suggestions can be determined such as specified below. Admittedly a business climate that supports creativity is the basic condition. The most important factors for the formation, development, deployment processes of the inovation for a country or enterprise, can be determined as following:

- Special attention should be given to the human factor as well as government policies in the innovation system for the creation of a technological infrastructure. The policies should be carried out in order to train scientists and researchers and in this way the quality of employees should be increased.
- Cultivating scientists and experts should be an important policy objective. Becauce universities and research institutions which are for the production of scientific knowledge in the innovation system lack of these scientists and experts.
- Today's globalization world, Turkey is behind the countries in the race for innovation because of insufficient investments and incentives. University and industry collobrated platforms should be activated and extended.
- Awareness should be created about R&D and innovation on the private enterprises, disclosures should be implemented, especially among SMEs.
- In order to add impetus to a country's R&D and innovation processes, young people should be directed to science and technology. Later, application areas should

be cerated for these young people. For this reason, in order to give an innovative perspective to students in Turkey, innovation-based approach should be adopted especially in the age of high school and university education similar to North America countries.

- One reason for the lack of R&D and innovation studies in Turkey, is SMEs perspective that based on short-term expectations and percieving the high-budget investments unnecessary and costly. But it should be noted that, in medium and long term, R&D and innovation are an active areas with nondecreasing returns even in times of crisis. For this reason, SMEs should be informed about the benefits of long-term innovative studies.

- It is known that partnerships increases the competitiveness. Thus, SMEs that are similar or common areas, should be encouraged for partnerships. In this sense, cooperation between foreign companies and national SMEs should be provided.
- According to information obtained from sources utilized in our study, SMEs are acting with survival psychology in business life. Accordingly, SMEs are reluctant to bending issues considered not provide for the company in the current situation. New product development efforts of the companies that have a share of over 99% in all businesses in our country, will cause the gain advantage on issues such as reducing economic dependency of our country, obtaining high quality and cheap products. Therefore the understanding of SMEs' of new product development is of vital importance for our country. Gain understanding of product development in SMEs, can be achieved with a national policy, strictly. However, it will not be easy to direct such a large enterprise group to target. To overcome this, the SMEs should be considered regional and sectoral, specific policies should be developed for each region and sector. Policies to be implemented continuously supervised and supported by the central units.

- The overall of the SMEs configuration is commonly family-owned company. Accordingly,family members are usually chosen among the heads of SMEs. Instead of the family members, bringing professional people to management staff is a very important factor for SMEs to reach a corporate structure. Because, the transition from the labor-based production to technology-based requires adequately equipped in terms of technical knowledge. Nowadays, many SMEs which take part in construction of family-owned company and these SMEs' can have the managers who outside of the family at variety of management units. However, these managers

can't get expected efficiency from their working conditions and they come ineffective position at decision-making processes within the company. If non-family managers who have a certain level of education and experience and expected to have a positive impact in the company is supported in the company, it will be seen clearly that have a contribution to supporting the SMEs' innovation activities.

- The current perspective of the SMEs can be summarized as to maintain the existing conditions or support the development of a specific topic. This approach of the SMEs causes to arise the protector innovation enterprises based on short-term benefits. It was determined that many enterprises make the innovation for reduce the consumption of material, reducing labor costs and to saving energy. In addition, increasing the market share, technological developments, improving the quality of technological products and services, the changes according to the customer requests are evaluated as less important. As a result, the accpeteance of the concept of new product development should not be expected due to the current perspectives of SMEs, automatically. In order to achieve this, new product development processes should be highlighted with the local and national policies adopted by SMEs.

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Security Of Wi-Fi Networks

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Abstract: With the rapid increase in use of WLAN technology it is important to provide a secure communication over wireless network. This paper focuses on current security issues in Wi-Fi networks, and gives overview of already available set of security controls which can help organizations to secure their wireless LANs. The goal of this paper is to summarize existing means of securing Wi-Fi networks and to analyze the possible solutions for the Wi-Fi networks. Furthermore, the paper explains how the security mechanisms work and provide security in order to have best communication.

Keywords: wlan, wi-fi, wireless, security, network, wi-fi security, wps

1. INTRODUCTION

Personal computersappeared in the 1970s and they were meant to be placed on a desk. Then Laptop computers were invented in the 1980s and then handheld computers were invented in the 1990s. People began to use the portable devices in airplanes, automobiles, or anywhere outside.People wanted to access to the Internet wherever they were. Radio link is proposed as alternative way for connection to Internet. During World War II, the United States Army first used radio signals for data transmission (Tammie, 2005). In 1971, researchers at the University of Hawaii developed the world's first WLAN, or wireless local area network which was named ALOHANET which consisted of 7 computers that communicated in a bi-directional star topology (Maury, 2002). Wi-Fi was invented in 1991 by Vic Hayes in Nieuwegein, the Netherlands. At the beginning the name was WaveLAN which has speeds of 1Mbps/2Mbps and it was used for cashier systems (Schilling, 2007). Initially Wi-Fi was thought to have potential in replacing the current cell

phone internet technologies, but it was soon realized that its distance limitations would not allow for competition. However, wireless technologies have international standard transparency. Phones or devices equipped to use Wi-Fi technologies will work worldwide and allow for easy access to the internet. Current cell phone technologies like GSM or CDMA are spread randomly throughout the world and access is not always available with the equipment.

2. WHAT IS Wi-Fi?

Technology which allows devices to communicate without cords or cables is popularly called Wi-Fi (Wireless fidelity) and network which provides local connection is called wireless local area network (WLAN). It describes all network components that are based on one of the 802.11 standards. Mobile data devices (such as laptops, PDAs or phones) are used to connect to Wi-Fi access points (devices connected with wired network) in short proximity. Wi-Fi provides Internet connection to mobile user by using wired connection with Internet. Wi-Fi is generally much faster than data technologies operating over the cellular network like GPRS, EDGE, HSDPA, and EV-DO. Thanks to the Wi-Fi technology, wireless technology has transformed to an open solution for providing mobility and network services without the requirement of wired connection.

The Wi-Fi is currently the most widespread wireless networking mechanism for personal computers and organizations. Many users have installed Wi-Fi networks at home, and numerous corporations have added Wi-Fi access points to their wired networks. While wireless LAN provides greater mobility and flexibility, it also poses security risks to the organizations. Security in wireless networks is harder to provide than the wired networks because of their inherent broadcast nature. This is due to the fact that every packet transmitted in a wireless network can be intercepted by all nodes within the communication range of the transmitter. This underlying vulnerability not only makes security in wireless networks extremely important but also adds additional requirements like privacy, anonymity and resource optimization. These networks have given hackers new opportunities to gain unauthorized access to corporate computer systems and their data.

3. SECURITY PROBLEMS AND REQUIREMENTSOF Wi-Fi

In the wireless systems, having a secure network has become quite important due to the large number of people dependent on these systems in daily life. One of the most drawbacks of wireless networks is that that they are not as secured as wired networks and the data sent through wireless networks can easily be intruded and modified. In wireless networks the security is much more critical and compulsory than the wired networks; because the data is sent over the wireless network is actually broadcast for the neighborhood to hear. When sending a critical data over the airwaves, the wireless networks should not be used unless some countermeasures taken. All the wireless systems must have a specific level of security in order to have privacy when sending data over the network. For example when financial institutions, banks, military networks etc. send their sensitive data through a wireless networks, then some extra measures have to be taken to have privacy and confidentiality, otherwise the important data could end up in wrong hands and you can imagine how useful things become dangerous. Each security solution has to provide the security requirement above to make a secure WLAN. The network administrator must use the specific security mechanism in the WLAN in order to make the network consistent and scalable. Nowadays the wireless internet is growing very fast, so there is a great need to make communication secure; without it, this perfect and fast speed of data flow becomes useless for everybody.

Security is an important issue for wireless networks, especially for those security sensitive applications and data exchanges. Many users of data transmission devices (such as laptops, PCs, phones, etc.) demand for protectingdata being transferredbetween devices, and ensuring proper transfer. One of thegoals of current wireless standard was toprovide security and privacy that was 'Wiredequivalent' and to meet this goal, severalsecurity mechanisms were provided forconfidentiality, authentication, and accesscontrol. Unfortunately all of these can be easily broken (Kush & Kumar, 2005).The main points that are considered as securityparameters are:

- Authentication: It ensures thatcommunication from one node to other isgenuine. Only legitimate users can accessthe system and services.
- Access control: Access control is theconstraint that limits those who can utilizesystem resources. Two approaches areused, one is called 'access control list(ACL)' and other as 'closed network'.

- Availability: Availability ensures the serviceoffered by node will be available to its userswhen expected, in spite of attacks. Alsoonly legitimate users can access dataanytime.
- Confidentiality: It ensures that certain information is never disclosed to unauthorized entities. Personal or sensitive data is protected.
- Integrity: It protects nodes from maliciously altered messages.. It assures the data, system or platform has not been tampered with.
- Identity: An essential element in any security system is reliable, robust non-malleable identity.
- Non repudiation: It ensures that the origin of the message cannot deny having sent themessage.

Wi-Fi depends on the cryptographic methods to be well secured. In this paper, the WEP and WPA security mechanisms will be shown to provide the security. Privacy is one of the most important needs in network to secure the data from being watched by third party. The transmitted data in the network should not be readable by anyone but those communicating.

4. ATTACKS ON WIRELESS NETWORKS

There are many security threats and attacks that can damage the security of WLANs. Those attacks and threats can be basically classified into two main categories:

Logical Attacks
Physical Attacks

Logical Attacks

Logical attacks always related with the software, system and the sensitive data flowing through the network. In these types of attacks the main goal of the intruder is to find the code and software that will help the intruder to access the network the sensitive data. Some most common logical attacks are defined below.

- Brute Force Attacks against Access Point Passwords
- Spoofing of MAC address

- Denial of Service Attack
- Man in the Middle Attack
- Eavesdropping
- Dynamic Host Configuration Protocol Attack
- Reconnaissance Attacks

Brute Force Attacks against Access Point Password

A brute force attack is a trial-and-error method which is used to obtain information such as a user password or personal identification number. In a brute force attack, intruder uses automated software to generate a large number of guesses as to the value of the desired data.

Spoofing of MAC address

MAC spoofing is a technique for changing a Media Access Control (MAC) address of a network interface on a networked device. Normally the MAC address cannot be changed. However, there are some tools such which can make an operating system believe that the MAC address the user's address. The process of masking a MAC address is known as MAC spoofing. MAC spoofing is changing a computer's identity, for good or for bad reasons, and it is relatively easy process.

Denial of Service Attack (DoS)

A DoS attack is an attempt to make one or more computer systems unavailable. They are considered to as the most common type of security attacks. The target of the attack is to make the network inaccessible for the client. DoS attacks can be implemented by using Flood attack, SYN attack and Ping of death attack.

Man in the Middle Attack

A man in the middle attack is an unauthorized blocking of network traffic to get the secret information and modify the data packets on the network. A man-in-the-middle attack can be used to block an encrypted message exchange and make the recipient think the message is coming from his partner. The main target of this type of attack is to read and alter the data whenever intruder wants during the

communication session without knowing the hosts which is also known as session hijacking attack.

Eavesdropping

Eavesdropping is an attack in which the attacker passively monitors network communications for data, including authentication credentials. In the wireless network, eavesdropping by is the most indicative threat because the attacker can intercept the transmission over the air from a distance.

Dynamic Host Configuration Protocol Attack (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is a protocol which is used in the TCP/IP networking model toconfigure hosts attached to a network automatically. Specific attacks can usebroadcasted DHCP requests with spoofed MAC addresses.Some of DHCP attacks can be sued as a denial of service (DoS) attacks.

Reconnaissance Attacks

Attacks which are used to collect information about a targeted network and are called reconnaissance and they can information for DoS attacks. The reconnaissance attack consists on the following four processes which are sing sweep, sort scan, packet sniffer, and Internet Information Queries (IIQ).

Physical Attacks

Physical attacks are always related with the hardware and the design of the network. In this type of attack the target of the intruder is to block the network performance rather than searching for a sensitive data and then make some changes with the data. Some of the most popular physical attacks are:

- Rogue Access Points
- Physical placement of Access Points
- Jamming attacks
- Spam Attack

Rogue Access Points

Rogue access points are WLAN APswhich are not authorized to connect to a target network which is opening a wireless hole into the network. An attacker can plant a rogue AP, or an employee may accidentally create a security hole by plugging a non-secure access point into the network. In order to get rid of this type of attack, simple technique known as lock down mechanism is used. By installing this application the administrator will get the logs whenever attacker tries to add some application.

Physical placement of Access Points

Physical placement of APs is another security issue because placing APs in an unsecure place will expose it to physical attacks. The AP can be shut down easily by attackers and whole configuration will be lost and AP will come into default configuration.Because of that special care has to be taken in consideration when choosing physical location of the access points.

Jamming attacks

Jamming attack is achieved by transmitting a signal to the receiving antenna at the same frequency band as the originalsignal. An attacker with the can easily jam the 2.4 GHz frequency in a way that drops the signal to a level where the wireless network can no longer function.

Spam Attack

The purpose of spam is to flood messages over the whole network like traditional emails. The spam attack absorbs bandwidth, which is not scalable for the WLAN network.

5. SECURITY OF Wi-Fi

WEP

WEP is a well-known security protocol which is specified in the IEEE Wi-Fi standard, 802.11b. It is designed to provide a wireless networks with a level of security and privacy as a wired LAN. The aim of the WEP is to give protection to that offered by the wired network's physical security measures by encrypting data transmitted over the WLAN. WEP has well known security weaknesses and almost 13 years passed since its ratification, it is still widely used as a common option to secure communication on network.

To transfer data through the network WEP uses some encryption and decryption techniques. Encryption is achieved as:

- The secret PSK that is 40 bit long is hashed with Initialization Vector that is 24 bit.
- A PRNG is generated from the result of mixed IV and pre shared key to form a new sequential key.
- The plaintext and the ICV are hashed in the mixer, when a copy of plain text is transferred to integrity Algorithm the ICV is created.
- The sequential key and the result of hashed plaintext and ICV is transferred to RC4 algorithm, where RC4 algorithm performs the XOR operation to give the encrypted result.

In the end encrypted message can be obtained by first adding the IV in front of Cipher text.
Hence the encrypted message is ready to send across the air (Lashkari, Mansoor, & Danish, 2009).
Decryption: There are five steps helps to define how WEP works in order to decrypt the information.

- The pre shared key that is 40 bit long is hashed with IV that is 24 bit long and available in the encrypted information to generate a PRNG to form a sequential key.
- The cipher text that available in encrypted message and the Sequential key that is already generated are transferred into RC4 algorithm, which performs the XOR operation on both of them to form a plain text.
- The ICV is separated from the Plain text.

- Plain text is transferred to integrity algorithm to form a new ICV.
- The new ICV is compared with the original ICV, if the both ICV matched then the data becomes safe otherwise it is altered.

Hence the message is successfully decrypted and the original message is available at the recipient side (Lashkari, Mansoor, & Danish, 2009).
WEP is considered to be very vulnerable to attackers that any attacker close enough to the building can attack the building's WLAN security. The following known attacks are known to be effective on WEP:
Passive Attacks

- Dictionary based attacks
- Cracking the WEP key

Active attacks

- Authentication Spoofing
- Message Injection
- Message Modification
- Message Decryption
- Man in the Middle Attack

WPA

WPA is a security technology for wireless networks whichis stronger on the authentication and encryption than WEP. WPA providestwo standard technologies: Temporal Key Integrity Protocol (TKIP) and Advanced Encryption Standard (AES)to achieve better security. It also has built-in authentication support which WEP did not offer.

WPA utilizes its TKIP to improve data encryption which provides important data encryption enhancements including a per-packet key mixing function, a message integrity check (MIC), an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA also implements 802.1x and Extensible Authentication Protocol (EAP) provides better user authentication. These implementations provide a framework for strong user authentication.

Wi-Fi Protected Access 2 (WPA2)

WPA2 was introduced in September 2004 which is the second generation of WPA security. WPA2 uses PSK authentication but instead of TKIP encryption it uses enhanced data encryption which is a specific mode of the Advanced Encryption Standard (AES) known as the Counter Mode Cipher Block Chaining-Message Authentication Code (CBC-MAC) protocol (CCMP). WPA2 offers two modes of operation:

- WPA2-PSK (Pre-Shared Key) mode
- WPA2 Enterprise mode

In WPA2-PSK mode the 256-bit key is generated from plain-text passphrase called pre-shared key (PSK). Like WPA, the same input is used to generate the pairwisemaster key (PMK), which is used to initiate the handshake: passphrase, SSID andSSID length.

On the other hand, when WPA2 Enterprise mode is used, much more complex authentication schemes can be supported since authentication is performed with the aid of an Authentication,Authorization and Accounting (AAA) backend server. (Georgopoulos, McCarthy, & Edwards, 2011).

Wi-Fi Protected Setup (WPS)

WPS was introduced and developed by the Wi-Fi Alliance to simplify ways of setting up and configuring security on wireless networks. Users manually create a wireless network name, and then manually enter security key on both the access point and the client to secure their wireless network. However, this process requires the users to have the some knowledge on the Wi-Fi devices to make the configuration. WPS was introduced to remove the guess work of securing a wireless network by typing a short PIN (numeric code) or pushing a button. WPS automatically configures wireless networks with a network name (SSID) and strong WPA data encryption and authentication. WPS is a new standard which offers some alternative ways for clients to authenticate the wireless network which is meant to make wireless encryption easy to setup. WPS defines four new ways of authentication:

- The PIN method
- The Push Button Configuration (PBC) method
- The Near Field Communication (NFC) method
- The USB method

6. CONCLUSION

In this paper, an overview of security scheme in wireless networks is presented. Wirelesstechnology has been changing rapidly and as the time goes and networking technology improves, there is a long way to go for wireless networks to achieve security. The main goal was to show a preview of mechanisms used for securing wireless networks. In general some basic terms about WLANs werediscussed with possible attacks on WLANs.

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Concept of Environment, Health and Energy Systems in Turkey

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Abstract: Since the Chernobyl disaster in the Black Sea region, it has been understood that environmental problems are not restricted to the countries of their origin. Research has shown that international attention given to the Mediterranean Sea has generated a more positive impact on environmental protection, as com-pared to that of the Black Sea. Industrialization around the Black Sea during the Cold War, a lack of international attention for long decades, and the region's position since the Second World War as a crucial hub for the transport of the energy produced by Caucasian and Black Sea littoral countries to the energy consuming countries in Europe aggravated the environmental situation in the region. Pollutants created by chemical industries and oil leaking from tankers have caused a decrease in biological diversity. Thus, increased pollution in the sea en-tered the agendas of governmental and non-governmental international/regional organizations and individual states in the last two decades. Unfortunately, after the end of the Cold War and the collapse of the Soviet Union, the main priorities of the newly independent states included neither an increase of biological diver-sity nor a decrease in pollution. As the regional states put their efforts into competing in the international liberal market, they focused on increasing industrialization, trade and economic ties with the energy demanding countries. There are ten wind farms mainly on land clustered together in the west of the country and in the Aegean region, including in Çanakkale, close to the site of ancient Troy, Çeşme, Akhisar and on the island of Bozcaada. Wind powe in Turkey is gradually expanding in capacity. In 2006, 19 MW of wind power was installed, and in 2007, installed wind capacity increased to almost 140 MW. Turkey is set to double the

amount of its electricity supplied by wind power with the construction of a wind farm in southeast Turkey which will have an installed capacity of 135 megawatts (MW) when it is completed in 2009. This very important project will use 52 of the latest generation of turbines from GE Energy, each rated at 2.5 MW.] Installed wind power is expected to reach 808.81 MW by the end of 2008.Wind energy potential for Turkey is 58GW. The European Wind Energy Association stated that installed wind power capacity in Turkey at the end of 2009 was 801 MW. A total of 343 MW of capacity was installed in 2009. According to Official Transmission Reports, installed wind power capacity in Turkey at the end of 2010 has increased to 1265 MW. The installed capacity is specified as 1645,30 MW by October, 2011 by the same reports. At the end of 2012 there will be over 80 windfarms in Turkey. At the end of 2012 Turkey will have 2 GWs of installed capacity. The Turkish government has a target of a 20 times increase in wind capacity by 2020.

Keywords: environment, renewable energy, chernobyl disaster

1. INTRODUCTION

The most horrific technological catastrophe of the 20th Century is the Chernobyl Accident. Today, many people do not know where Chernobyl is situated. This small town is located on the Pripyat River, approximately 140 km from Kyiv, the capital of Ukraine. It was founded long ago, in the year 1193. Before this disaster in 1986, the population of Chernobyl was only 12,000 inhabitants.

Now, the small town of Chernobyl is known for its nuclear power plant and this 1986 accident, which is considered to be the most terrible nuclear accident in the world's history. Since then, this accident has raised many world-wide discussions about the safety of all nuclear power plants.

The 1986 Chernobyl disaster happened on the April 26, 1986 at 1:23 AM, when a powerful explosion destroyed the 4th power block of the nuclear power plant. The Chernobyl incident was the reason for the most terrible radiation emission in the world's history. This caused serious social and economic problems for the population of the former Soviet Republics of Ukraine, Belarus and Russia. 70% of the radioactive fallout from Chernobyl disaster landed in Belarus, affecting approximately 3,500 towns and villages, and about 2.5 million people.

This Chernobyl accident influenced the lives of thousands of people. The whole town of Pripyat with a population of 49,360 people was completely evacuated

within 36 hours after the Chernobyl accident. During the subsequent weeks and months, an additional 67,000 people were evacuated from their homes in the affected areas. In total about 200,000 people were evacuated as a result of the Chernobyl incident (3)

Table: 1. Summary of average accumulated doses to affected populations from Chernobyl fallout (7)

Population category	Number	Average dose (mSv))
* including 240 000 who worked in 1986–87.		
Liquidators (1986–1989)	600 000*	~100
Evacuees from highly-contaminated zone (1986)	116 000	33
Residents of "strict-control" zones (1986-)	270 000	>50
Residents of other 'contaminated' areas (1986-)	5 000 000	10-20

Source: UN Chernobyl Forum (2006)

Especially nuts, tea etc. which has been produced in Turkey analisied in scientific laboratories and some of the products were in very dramatic points after Chernobyl accident. Children who had consumed milk from cows that had eate contaminated grass were particularly affected, and many of them went on to develop thyroid cancer. Some people, such as those living in Pripyat, very near the Chernobyl power plant, were given stable iodine tablets which substantially reduced the amount of radioactive iodine accumulated by their thyroid glands

The Great East Japan Earthquake with a magnitude of 9.0 took place at 2:46 PM on Friday, March 11, 2011. It did considerable damage in the entire region, and the large tsunami it created caused even more extensive damage. The earthquake was centered 130 km offshore from the city of Sendai in Miyagi prefecture on the eastern cost of Honshu Island (the main part of Japan). It was a rare and complex double quake with a duration of about 3 minutes. Japan moved a few meters east and the local coastline subsided half a meter. The tsunami inundated about 560 square km and resulted in a human death toll of over 19,000 and much damage to coastal ports and towns with over a million buildings destroyed or partly collapsed. Eleven reactors at four nuclear power plants in the region were operating at the time and all shut down automatically when the quake hit. Subsequent inspection showed no significant damage to any from the earthquake. The operating units which shut down were Tokyo Electric Power Company's (Tepco) Fukushima Daiichi 1, 2, 3,

and Fukushima Daini 1, 2, 3, 4, Tohoku's Onagawa 1, 2, 3, and Japco's Tokai, total 9377 MWe net. Fukushima Daiichi units 4, 5 & 6 were not operating at the time, but were affected. The main problem initially centered on Fukushima Daiichi units 1-3. Unit 4 became a problem on day five.

The reactors proved robust seismically, but vulnerable to the tsunami. Power, from grid or backup generators, was available to run the Residual Heat Removal (RHR) system cooling pumps at eight of the eleven units, and despite some problems they achieved 'cold shutdown' within about four days. The other three, at Fukushima Daiichi, lost power at 3:42 PM, almost an hour after the quake, when the entire site was flooded by the 15-meter tsunami. This disabled 12 of 13 back-up generators on site and also the heat exchangers for dumping reactor waste heat and decay heat to the sea. The three units lost the ability to maintain proper reactor cooling and water circulation functions. Electrical switchgear was also disabled. Thereafter, many weeks of focused work centered on restoring heat removal from the reactors and coping with overheated spent fuel ponds. This was undertaken by hundreds of Tepco employees as well as some contractors, supported by firefighting and military personnel. Some of the Tepco staff had lost homes, and even families, in the tsunami, and were initially living in temporary accommodation under great difficulties and privation, with some personal risk. A hardened emergency response center on site was unable to be used in grappling with the situation due to radioactive contamination. Three Tepco employees at the Daiichi and Daini plants were killed directly by the earthquake and tsunami, but there were no fatalities from the nuclear accident.

Japan also participated in the tender for the construction of a nuclear power plant in Sinop, Turkey, but Turkey excluded Japan’s bid due to the inferiority of the proposed project.

The Akkuyu nuclear power plant will be built on a Russian project which includes the construction of four power units with VVER-1200 reactors. The agreement on the construction of the station was signed in May 2010. The capacity of each unit will reach 1200 MW, while the total capacity is 4800 MW. It is assumed that the units will be commissioned in sequence at intervals of one year.

Turkey's reliance on imported natural gas for power generation has given rise to concerns over supply security and the country's growing current account deficit.

Support of domestic energy sources such as coal and renewables has gained a new urgency. More steps need to be taken to improve the investment environment for renewable energy in Turkey. Wind power boasts the second highest share of renewable energy production in Turkey, and its prospects look brighter each day. According to 2010 data from the Turkish power-generation corporation, electricity generated from renewable resources had a 19.7% share of total power, 18.5% hydroelectric energy, 0.8% wind power and 0.4% for other renewables, such as landfill gases, biogas, and biomass. By comparison, 48.6% of total energy was supplied by natural gas and 31.7% by petroleum and coal. Yet by the end of 2011, this breakdown had begun shifting in favor of renewable resources, with wind energy now amounting to 2% of total power generation in Turkey (4)

Turkey's ambitions aren't just limited to erecting wind farms on its soil, but also to eventually compete with China in the manufacture of wind turbines. To make up for its limited know-how, Turkey is more than willing to open up to the technologies of other countries. In order to promote the Turkish energy market, the sector organizes many trade fairs as well as regular networking events, all in the name of attracting foreign investment. With its advantageous geography, it seems Turkey will soon be strengthening its foothold in the energy sector.

Apart from the need to develop cost-effective energy supply strategies, the rapidly growing energy demand in Turkey results in the increasing importance of the control of air, soil and aquifer pollution. Turkey's request for admission into the European Community (EC) in 1987 makes it crucial to harmonize these present activities with their air pollution and water control strategies (6)

Meanwhile, before the nuclear power plants are constructed and operated in Turkey, the official Institutes and Government Administrations should do a number of scientific researches in terms of radiation and especially radionucleid (caesium-137) levels in marine environment (1). Additionally, national universities in Turkey may cooperate with the other highly trusted universities (especially, the USA, England, Russia, Belarus and Ukraine) more on living safe and healthy in Turkey and its neighbours.

Turkey is also focusing on environment and energy policies in its relations with its neighbors. Droughts, decreases in water resources, transit passage oil tankers through the Black Sea and the Turkish Straits and a decline in biodiversity force

Turkey to emphasize the access and use of environmentally friendly energy. However, economic and geopolitical concerns are also playing a crucial role in agreements with the energy producing countries. This paper demonstrates the dichotomy between energy and environment policies in the Black Sea region and Turkey, with references to international and regional needs.

2. MATERIAL AND METHODS

The following topics and issues are discussed in scientific areas:

- Introduction to World Energy Model (WEM)
- Input requirements: sources of energy and economic statistics; assumptions used
- Turkey's development: parameters, accuracy and sensitivity; business-as-usual vs. climate factors
- Country-wide energy demand modeling: by sector and fuel
- Power generation modeling: technologies and fuel mix needed to meet future demand
- Transport sector modeling: by mode of transport
- Oil, gas and coal production modeling
- Carbon dioxide (CO2) emissions modeling
- Nuclear energy, conservation technologies and strategies
- Education programs for energy, health and environment on every level

3. RESULTS AND DISCUSSION

Reducing poverty and achieving sustained development must be done in conjunction with a healthy planet. The Millennium Development Goals (MDGs) recognize that environmental sustainability is part of global economic and social well-being. Unfortunately, exploitation of natural resources such as forests, land, water, and fisheries - often by the powerful few - have caused alarming changes in our natural world in recent decades, often harming the most vulnerable people in the world who depend on natural resources for their livelihood.

Basically, the Baltic Sea, the Black Sea, the North Sea and Lake Zurich have been most affected in terms of sediment, seafood, and water. Radionucleid levels

(caesium-137) were determined two to three orders of magnitute higher than the pre-Chernobyl disaster's levels (2). On the other hand, radioactive contamination caused that the birds avoid testing in density radioactivity regions (8).

The exposure of the population in southern Belarus, northern Ukraine and the regions of Russia that border these two countries, to radioiodine in fallout from the Chernobyl accident in 1986, resulted in a definitely increase in those who were young children at the time of the accident [10).

As the normal frequency of thyroid cancer in children is so low, the sudden increase in thyroid cancer in the population exposed to fallout provided an opportunity to study not only the relationship between radiation exposure and the risk of thyroid cancer in the population using epidemiological methods, but also to correlate the molecular biology of thyroid cancer with exposure to radiation. The Chernobyl Tissue Bank (CTB) was established in 1998, 6 years after the first publications indicating that there was a sharp rise in childhood thyroid cancer [11,12]. The first international co-operation that seeks to establish a collection of biological samples from patients for whom the aetiology of their disease is known — exposure to radioiodine in childhood.

Among hundreds of aftershocks, an earthquake with a magnitude of 7.1, closer to Fukushima than the March 11th one, was experienced on April 7th, but without further damage to the plant. On April 11th there was a magnitude 7.1 earthquake and on April 12th a magnitude 6.3 earthquake, both with epicenters at Fukushima-Hamadori, and neither of which caused further problems.

The rockfish, caught at a port inside the devastated Fukushima Daiichi nuclear power plant last week by TEPCO, measured 240,000 Becquerel of cesium – 2540 times Japan's legal limit for seafood (9)

Turkey's vulnerable ecosystem has been placed under increasing stress by high population growth, rising incomes and energy consumption. In Turkey, as elsewhere in the world, environmental problems, such as water shortages, land degradation, and lack of clean and affordable energy resources severely hinder efforts to achieve sustainable development. In addition to these problems, climate change poses a threat to the achievement of the MDGs and related national poverty eradication and sustainable development objectives.

To help Turkey find solutions, UNDP works closely with a number of government agencies, municipalities, private sector partners and NGOs, to integrate environmental and sustainable development principles into national and regional development policies and plans. UNDP Turkey not only promotes mainstreaming environment, climate change and energy efficiency into sectorial policies, but also supports strengthening the institutional and policy capacities.

4. CONCLUSION

Despite of very hazardous results for health and environment nowadays, nuclear power plants are very effective in terms of energy production in the World. Distribution of the nuclear power plants in terms of amounts and capacity according to countries as below.

Table 1: Nuclear power plants world-wide, in operation and under construction(2)

country	in operation		under construction	
	number	net capacity MWe	number	net capacity MWe
Argentina	2	935	1	692
Armenia	1	375	-	-
Belgium	7	5,927	-	-
Brazil	2	1,884	1	1,245
Bulgaria	2	1,906	-	-
Canada	19	13,665	-	-
China				
Mainland	17	12,816	29	28,753
Taiwan	6	5,018	2	2,600
Czech Republic	6	3,766	-	-
Finland	4	2,736	1	1,600
France	58	63,130	1	1,600
Germany	9	12,068	-	-
Hungary	4	1,889	-	-
India	20	4,391	7	4,824
Iran	1	915	-	-
Japan	50	44,215	3	3,993
Korea, Republic	23	20,754	4	4,980
Mexico	2	1,300	-	-
The Netherlands	1	482	-	-
Pakistan	3	725	2	630
Romania	2	1,300	-	-
Russian Federation	33	23,643	11	9,927
Slovakian Republic	4	1,816	2	782
Slovenia	1	688	-	-
South Africa	2	1,830	-	-
Spain	8	7,560	-	-
Sweden	10	9,395	-	-
Switzerland	5	3,263	-	-
Ukraine	15	13,107	2	1,900
United Arab Emirates	-	-	1	1,345
United Kingdom	16	9,246	-	-
USA	104	101,465	1	1,165
Total	437	372,210	68	65,406

Turkey does have any nuclear power plants at present but the plant will be constructed araound Akkuyu in future. However, there are some risks at this level. First of all, the model which suggested by Russia, it has been never applied before…(5)

• Safety related risks,
• Production/operational risks,
• Commercial/financial risks,
• Strategic risks.

Another alternative that has been debated is nuclear energy. Increasing population, developing economies, and increasing energy needs push countries to find new, effective energy resources. Like other developing countries, Turkey has started to consider nuclear energy power plants again with an aim to save itself from dependency on energy producing countries. However, we have to establish effective technological safeguards against any potential nuclear disaster in Turkey.

Greater use of nuclear power is not inevitable. We should urge politicians to establish an international law to ensure that nuclear waste generated by a country is disposed of in that country. This would prevent expensive and dangerous waste being transported half way around the globe. Ships are vulnerable to piracy and terrorism. A collision, sinking, or running aground would be a major disaster.

We should also campaign for more government assistance to develop renewable energies that are greenhouse neutral and to expedite research into methods of producing clean-burning coal and the disposal of any carbon dioxide generated.

- Join local Direct Action groups promoting alternatives to nuclear energy.
- Invest in alternative technology companies.
- Buy alternative systems such as solar cells for home use.
- Encourage local councils and schools to purchase alternative energy technology.

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Energy efficiency measures in power utilities on the track of an efficient and low-carbon Europe in 2030 - Case study of EPBiH

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Abstract: This paper describes measures which are being undertaken by EPBiH power utility, largest public electricity utility in Bosnia and Herzegovina, to improve its energy efficiency and keep on the track of the European targets outlined in the EU strategic documents and laid down by new energy efficiency Directive 2012/27/EU. By modernization its existing power plants performed in last 10 years, EPBiH improved net efficiency and reduced its CO_2 emission for 30% compared to 1990 levels. Plan till 2030 is further increasing the net efficiency up to 40.2%. With introducing Energy Management System, energy efficiency has been involved into all sectors of the company; from coalmines, generation and distribution, to the energy supply, to comply the business model with EU energy efficiency targets and legislation.

Keywords: Energy efficiency, CO_2 emission, coal-based power plants, decarbonisation

1. INTRODUCTION

The energy challenge is one of the greatest tests faced by World today. Key decisions have to be taken to reduce drastically CO_2 emissions and fight climate change. The European Council in 2007 adopted energy and climate change objectives for 2020 – to reduce GHG emissions by 20%, rising to 30% if the conditions are right, to

increase the share of renewable energy to 20%, and to make a 20% improvement in energy efficiency. EU 2020 energy strategy provides a solid and ambitious European framework for energy policy based around five pillars of action. However, Europe's energy systems are adapting too slowly. There are still many barriers to open and fair competition. The security of internal energy supplies is undermined by delays in investments and technological progress. Currently, only 45% of European electricity generation is based on low-carbon energy sources, mainly nuclear and hydropower. Parts of the EU could lose more than a third of their generation capacity by 2020 because of the limited life time of these installations. This means replacing and expanding existing capacities, finding secure non-fossil fuel alternatives, adapting networks to renewable energy sources and achieving a truly integrated internal energy market. The European Council has also given a long-term commitment to the decarbonisation path with a target for the EU and other industrialized countries of 80 to 95% cuts in GHG emissions by 2050 (Energy roadmap 2050). The European Commission set out in 2011 sectorial carbon dioxide (CO_2) reduction trajectories with a mid-term view on 2030 to steer the decarbonisation of the economy on a manageable and cost-effective course. For the power sector, a CO_2 reduction range of between 54% and 68% was proposed by 2030 compared to 1990 levels. It was analyzed in details in Power Perspectives 2030, to response what is required between today and 2030 to remain on a pathway to a decarbonised power sector by 2050.

2. ENERGY EFFICIENCY REQUIREMENTS FOR LARGE POWER UTILITIES

Energy efficiency is the central objective both for energy 2020 and energy roadmap 2050 – it is a key factor in achieving long-term energy and climate goals. Efficiency, including in electricity use, must become a profitable business in itself, leading to a robust internal market for energy-saving techniques and practices and commercial opportunities internationally. Special attention should be given to the sectors with the largest potential to make energy efficiency gains. Beside the existing building stock and transport sector, industry sector, and particularly power industry, is in the focus. As set in EU strategic documents, as well as in new energy efficiency Directive 2012/27/EU, the industry sector needs to incorporate energy efficiency objectives and energy technology innovation into its business model. The ETS contributes significantly to doing so for larger companies, but there is need for a

wider use of other instruments, including energy audits and energy management systems in smaller companies and supporting mechanisms for SMEs. Efficiency benchmarking can indicate to companies where they stand in efficiency terms in comparison with their competitors.

For power industry, energy efficiency in both production as well as distribution should become an essential criterion for the authorization of generation capacities, and efforts are needed to substantially increase the uptake of high-efficiency cogeneration, district heating and cooling. Distribution and supply companies (retailers) are required to secure documented energy savings among their customers, using means such as third-party energy services, dedicated instruments such as 'white certificates', public benefit charges or equivalent and speeding up the introduction of innovative tools such as 'smart meters' which should be consumer-oriented and user-friendly so that they provide real benefits for consumers.

3. ENERGY EFFICIENCY IN EPBIH - CURRENT STATE, PLANS AND MEASURES

3.1. Power system under consideration –EPBiH power utility

Bosnia and Herzegovina is a contractual party of Energy Community Treaty, with set obligations in domain of Electricity, as well as Environment, Energy Efficiency and RES. The EU acquis in domain of energy is being transposed into the national legislative, that process is on-going. Among three public power utilities in Bosnia and Herzegovina, JP Elektroprivreda BiH d.d.-Sarajevo (EP BiH) is the largest one, both by the installed power capacity and by level of electricity and heat production. Average annual 8 000 MWh of electricity is generated in two coal-based power plants - TPP Tuzla (1x110 MW + 2x200 MW + 1x225 MW installed electrical power) and TPP Kakanj (2x118 MW + 1x235 MW installed electrical power), in three large hydro power plants – HPP Neretva (6x30 MW + 2x57 MW + 3x70 MW), with a participation of small HPP (sHPP) of 1% in the total power generation. Both of the thermal power plants use domestic low-rank coal, with an annual coal consumption of app. 6 500 000 t. The current power generation capacity structure in favour of thermal power plants provides some grounds like security and reliability of supply, but further penetration RES into generation portfolio is necessarily in order to contribute to the long-term sustainable

development plans of the company and to comply with the European targets for increase of energy efficiency and reduction of GHG emissions. EPBiH supplies electricity to near 750 000 its consumers in Bosnia and Herzegovina, via its distribution network operated by EPBiH distribution company organized in five regional distributive parts. Furthermore, EPBiH exports about 20% of electricity. Annual production of heat energy, generated in cogeneration power units of TPP Tuzla and TPP Kakanj, is app. 400 GWh. The heat energy for heating is supplied over long-distance district heating systems to the consumers in the city of Tuzla and city of Lukavac (from TPP Tuzla) and city of Kakanj (from TPP Kakanj). A part of the heat energy (steam) is supplied from TPP Tuzla to the process industry in Tuzla region.

3.2. Energy efficiency and CO_2 emissions in EPBiH - current situation

In past ten years, by different measures that have being undertaken in generation and distribution sectors of the company, energy efficiency in EP BiH is increased in 30% compared to the 1990 level. In generation sector, by appropriate measures like decommissioning old power units (4x32 MW in TPP Kakanj and 2x32 MW in TPP Tuzla) because of exausted life time and low efficiency of these installations, as well as modernisations all other existing coal-based power units in period between 2002 and 2012, total net efficinecy of the power plants EP BiH was increased from 24% up to 31%, which is an increasing of app. 30%. For the same period, for comparable electricity production to the 1990 level, CO_2 emission was reduced from 9.500.000 t/a (1990) to the current 6 500 000 t/a (A.Kazagic, 2012, Documents of EMS EP BiH).

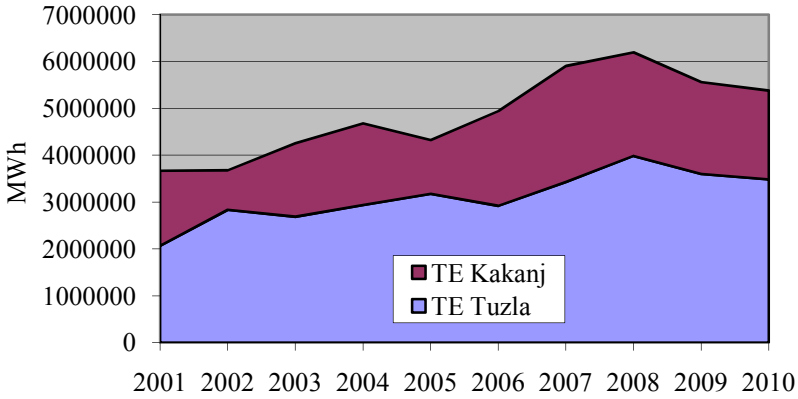

Figure 1. Power generation in coal-based power plants EPBiH, 2001-2010

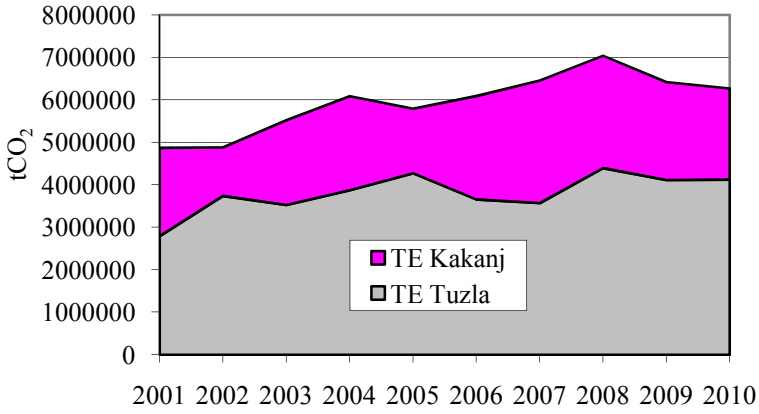

Figure 2. CO_2 emissions from thermal power plants EP BiH in period 2001-2010

Increasing of energy generation in coal-based power plants EPBiH in last ten years, Figure 1, have been accomponied by an increasing annual CO_2 emissions as well, Figure 2. However, it can be noted that gradient of increasing CO_2 emissins is lower compared to the gradient of increasing power production, which is result of the performed modernizations. Consequently, the specific CO_2 emission in that period was reduced for almost 12%, Figure 3.

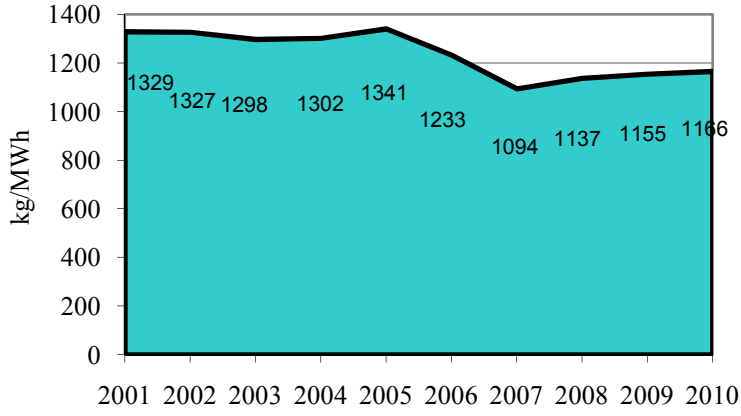

Figure 3. Specific CO_2 emissions for power plants EP BiH in period 2001-2010

The major measures for improvement energy efficiency in coal-based power plants EPBiH that have been implemented through the modernization campaigne in last

ten years, can be summerised in increasing boiler efficiency by modernization of the boiler design and replacing the combustion system, replacing LP and HP steam turbine parts by a novel modern design, modernization of generator and improvments of cooling towers. After last modernization performed on TPP Tuzla Unit 6-225 MW (the modernised unit commissioned in January 2013), average heat consumption rate of thermal power plants EP BiH reduced at 11 722 kJ/kWh (net efficiency 30.71%). This is the highest average net efficiency of the thermal power plants EPBiH so far.

Energy savings and emission of CO_2 in EP BiH are strongly influenced by the contribution of RES to the power generation. Current average value of Renewable Index (as ratio of electricity generation from RES and the total electricity generation) is 30%, with a variation during year as shown in Figure 4, caused by a different monthly inflow of the water into the accumulations of hydro power plants EP BiH. In the same time, Renewable Index also effects on CO_2 emission, considering complete power generation portfolio EP BiH. Thus, current EP BiH net emission rate (specific CO_2 emission of EP BiH) is 860 kg/MWh, Figure 5, which is a value very close to the national net emission rate.

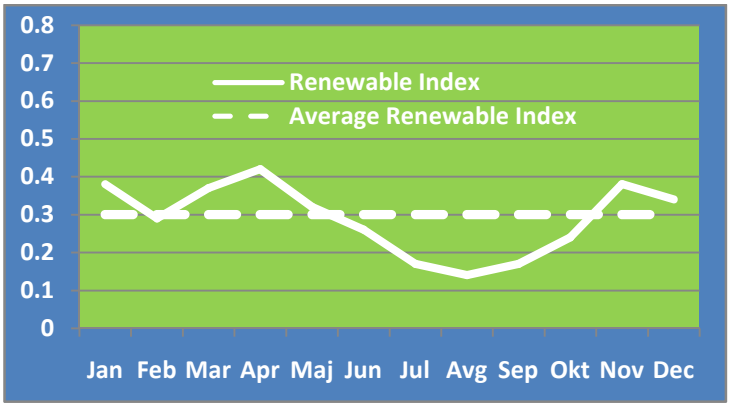

Figure 4. Renewable Index of EP BiH

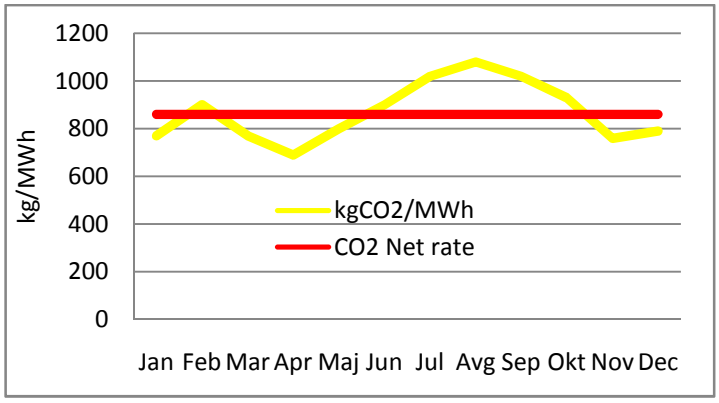

Figure 5. EPBiH Net CO_2 rate

In recent years, energy efficiency in EPBiH distributive company was also improved significantly, through decreasing distributive losses. Thus, by elimination forbiden consumption, better organization and innovation of measurements and mettering, as well as applying new technologies, distributive losses have been reduced to 9%, that is the best result in the region of South East Europe, and comparable with developed countries.

3.3. Energy Management System of EP BiH

Taking efforts to involve energy efficiency into all processes and activities in the company, in 2010 EP BiH decided to introduce Energy Managment System (EMS). Policy on Energy Efficieny was set out, and a structure of experts with clear responsibilities was established to manage energy efficiency in the company. The EMS structure was established taking into account the basic company organization, its businesses, level of fuel and energy consumptions.

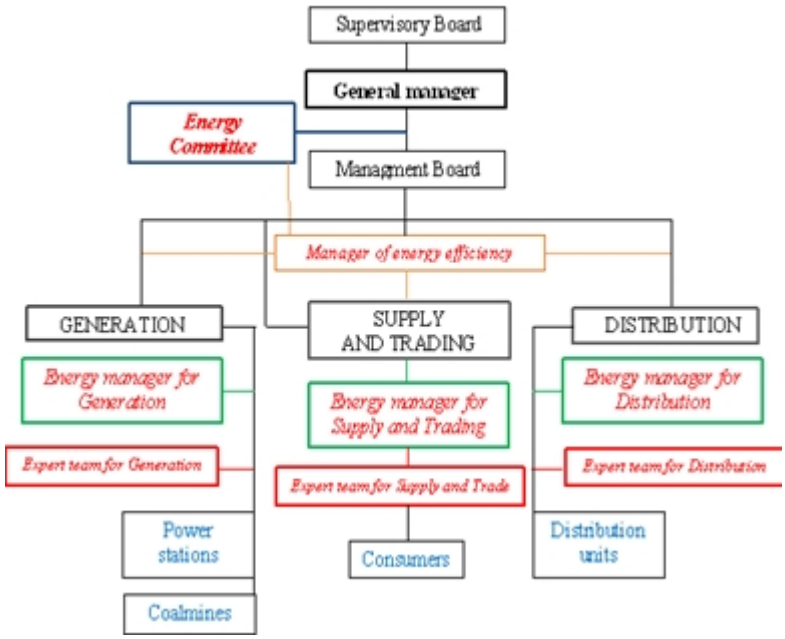

Figure 6. Major scheme of Energy Managment System structure in EP BiH

As shown in Figure 6, four level of authorities have been appointed: (i) *Energy Committee,* responsible for the energy efficiency targets and plans, (ii) *Manager for energy efficiency,* as major operational authority in the company responsible for all energy efficiency activities, (iii) *Energy managers for Power generation, Distribution, and Supply,* as main operational authorities in their sectors, and (iv) *Teams for Energy efficiency in Power generation, Distribution, and Supply*, responsible for implementation the measures. Major objectives of EMS of EP BiH are more efficient energy consumption, reducing fossil fuel consumption, reducing GHG emissions and contribution to the fight climate change, reducing the costs, as well as involving all the employees to contribute to the energy savings. Today, through EMS EPBiH, energy efficiency targets and plans are set, the measures are defined, promotional activities, energy audits, services towards consumers, educations and trainings, and all other energy efficiency actions in the company are carried out.

4. PROJECTIONS OF ENERGY EFFICIENCY AND CO_2EMISSIONS IN EP BIH FOR 2030 - RESULTS AND DISCUSSION

Despite of the energy efficiency improvements achieved in the last years, EPBiH is still far behind the most developed power utilities in Europe as energy efficiency is concerned. This could be addressed to the older technologies which are still involved in some installations within the power system EPBiH. Today, EPBiH is facing with new chalanges; further energy efficiency improvements and CO_2 reduction, mandatory for the company to keep and improve its position on the market (competitevness) and to comply with the energy efficiency and climate regulation, as well as low-carbon future. Considering the expected annual power demand figure in EP BiH till 2030, as well as the planned development of the generation portfolio which will include new 600 MW in hydropower, penetration of 300 MW of power from wind energy, replacement the existing coal-based power units by new CCS-ready and more efficient power units, it is projected a further incerasing energy efficiency of the thermal power plants; from the present level of 30,7% up to 34.9% in 2020, and up to 40.2% in 2030, Figure 7. This scenario also includes expansion cogeneration for the purpose of heating, both in TPP Kakanj (new 200 MWt for long-distance distring heating of city of Zenica and new 400 MWt for long-distance distring heating of city of Sarajevo) as well as in TPP Tuzla (new 70 MWt for long-distance distring heating of city of Zivinice).

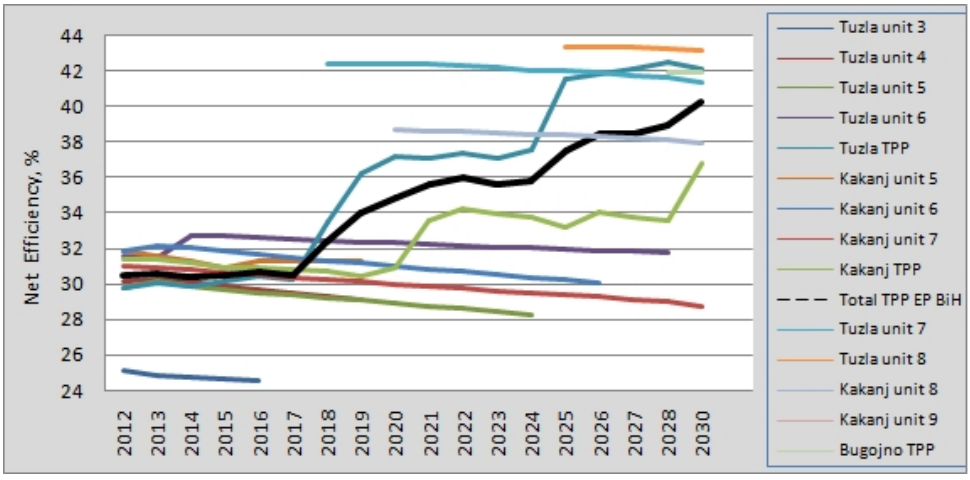

Figure 7. Projections of net efficiency of power plants EPBiH in period 2012-2030.

To improve CO_2 emission further, co-firing coal with biomass is planned on all power plants EPBiH. Projected use 7%w of biomass for average operation 3 000 h per year, will reduce total CO_2 emission of EPBiH for additional 4% [A.Kazagic, 2012]. Following up the planned energy efficiency and CO_2 reduction measures, projected reduction of specific CO_2 emissions of the thermal power plants EPBiH in period from 2012 till 2030 is shown in Figure 8.

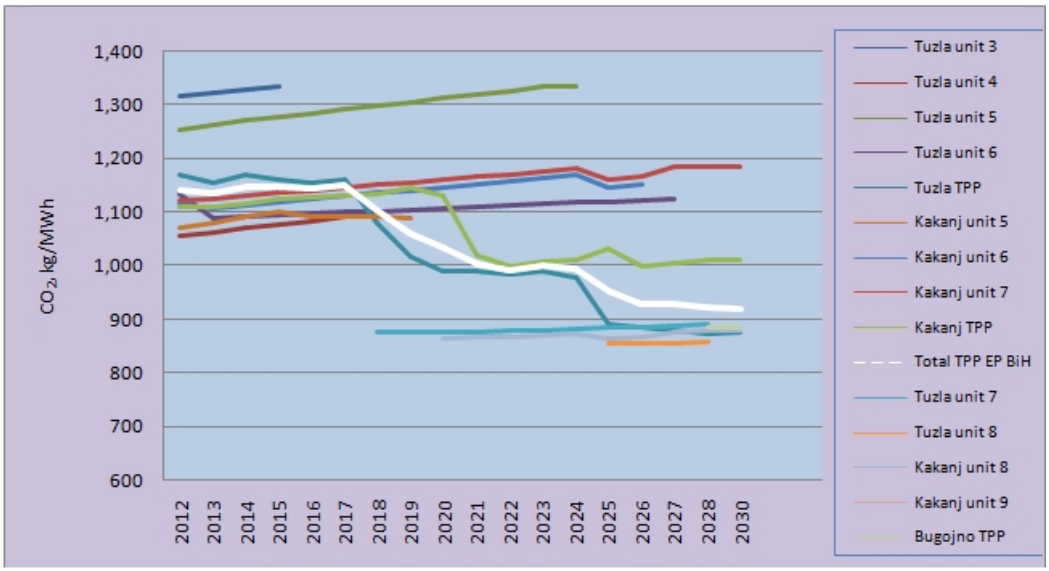

Figure 8. Projections of specific CO_2 emissions of EPBiH in period 2012-2030.

4. CONCLUSION

Energy efficiency is the central objective of European energy sector and a key factor in achieving long-term energy and climate goals. To comply its business model with EU energy efficiency targets and energy efficiency legislation, in 2010 EPBiH introduced Energy Management System. In past ten years, energy efficiency in EP BiH power utility is increased in 30% compared to the level in referent 1990 year. For the same period, CO_2 emission was reduced from 9 500 000 t/a (1990 level) to the current 6 500 000 t/a. It is projected further incerasing energy efficiency of the thermal power plants; from the present 30.7% up to 34.9% in 2020, and up to 40.2% in 2030, resulting in an energy efficiency increase of 67% compared to the 1990 level. It will be followed up by the consequent reduction of specific CO_2

emissions, supported by use of biomass in the coal-based power plants and further RES penetration into the power system.

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Microalgae for Renewable Energy: Biodiesel Production and other Practies

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Abstract: Sustainable production of renewable energy is being frequently debated globally since it is increasingly understood that first generation biofuels, primarily produced from food crops and mostly oil seeds are limited in their ability to achieve targets for biofuel production, climate change mitigation and economic growth. Currently, biodiesel is made from a variety of feedstocks, including pure vegetable oils, waste cooking oils, and animal fat; however, the limited supply of these feedstocks impedes the further expansion of biodiesel production.

Microalgae have been recognized as potentially good sources for biofuel production because of their high oil content and rapid biomass production. In recent years, use of microalgae as an alternative biodiesel feedstock has gained renewed interest from researchers, entrepreneurs, and the general public. Food sourced feedstocks biodiesel concerns have increased the interest in developing second generation biofuels produced from non-food feedstocks such as microalgae, which potentially offer greatest opportunities in the longer term. Using algae as a feedstock for biodiesel has been considered for a number of years, but it has always had limitations, due mainly to the production methods used to grow and harvest the algae.

This paper reviews the current status of microalgae use for biodiesel production, including their cultivation, harvesting, and processing. The microalgae species most used for biodiesel production are presented and their main advantages described in comparison with other available biodiesel feedstocks. The various aspects associated with the design of microalgae production units are described, giving an overview of the current state of development of algae cultivation systems (photo-bioreactors and open ponds). Other potential applications

and products from microalgae are also presented such as for biological sequestration of CO_2, wastewater treatment, in human health, as food additive, and for aquaculture.

Keywords: Sustainable energy, biodiesel, algae, biomass.

1. INTRODUCTION

Renewable energy plays a critical role in addressing issues of energy security and climate change at global and national scales. High petroleum prices demand the study of biofuel production. Lower-cost feedstocks are needed since biodiesel from food-grade oils is not economically competitive with petroleum-based diesel fuel. Biodiesel is produced currently from plant and animal oils, but not from microalgae. This is likely to change as several companies are attempting to commercialize microalgal biodiesel. Biodiesel is a proven fuel. Technology for producing and using biodiesel has been known for more than 50 years (Knothe et al., 1997; Fukuda et al., 2001; Barnwal and Sharma, 2005; Demirbas, 2005; Van Gerpen, 2005; Felizardo et al., 2006; Kulkarni and Dalai, 2006; Meher et al., 2006). Production of biodiesel from micro algae is a newly emerging field and appears to be a potential alternative. Biodiesel is produced from microalgal oil, thus crude fossil petroleum can be substituted by mass cultured biomass's microalgal oil for eco-sustainable biodiesel production in the near future. Sources of commercial biodiesel include canola oil, animal fat, palm oil, corn oil, waste cooking oil, and jatropha oil. The use of plant oils for fuel production is however highly controversial and requires resources such as arable land which may not be available in large enough quantities to meet fuel requirements of a designated area and will greatly affect food security. One of the most efficient ways is through utilization of the algal oils to produce biodiesel. Some algae can even produce hydrogen gas under specialized growth conditions. More than 95% of biodiesel sources are first generation agricultural edible crop oils. First generation biofuels have a great impact on food security and have the potential to increase the cost of food crops such as soybean thus also making biodiesel production more expensive. Second generation biofuels such as jatropha oil, waste cooking oil and animal fats do not affect food security and have significant advantages over first generation oil crops. Microalgae have greater photosynthetic efficiency than terrestrial plants and require very little simple nutrients supply for growth. The lipid content of microalgae, on a dry cellular weight basis generally varies between 20% and 40%, however lipid contents as high as 85% have been reported for certain microalgal strains.

2. MICROALGAE

Microalgae are the largest autotrophic microorganisms of plant life taxa in the world. Microalgae are known to synthesise and can rapidly accumulate substantially higher amounts of lipids than terrestrial plants due to their high growth rates, concomitantly by alteration of the lipid biosynthetic pathways for storage as neutral lipids. Microlgae, recognised as one of the oldest living organisms, are thallophytes (plants lacking roots, stems, and leaves) that have chlorophyll *a* as their primary photosynthetic pigment and lack a sterile covering of cells around the reproductive cells. While the mechanism of photosynthesis in these microorganisms is similar to that of higher plants, they are generally more efficient converters of solar energy because of their simple cellular structure. In addition, because the cells grow in aqueous suspension, they have more efficient access to water, CO_2, and other nutrients. Microalgae can be either autotrophic or heterotrophic. If they are autotrophic, they use inorganic compounds as a source of carbon. Autotrophs can be photoautotrophic, using light as a source of energy, or chemoautotrophic, oxidizing inorganic compounds for energy. If they are heterotrophic, microalgae use organic compounds for growth. Heterotrophs can be photoheterotrophs, using light as a source of energy, or chemoheterotrophs, oxidizing organic compounds for energy. Microalgae are able to fix CO_2 efficiently from different sources, including the atmosphere, industrial exhaust gases, and soluble carbonate salts. Fixation of CO_2 from atmosphere is probably the most basic method to sink carbon, and relies on the mass transfer from the air to the microalgae in their aquatic growth environments during photosynthesis. However, because of the relatively small percentage of CO_2 in the atmosphere (approximately 0.036 %), the use of terrestrial plants is not an economically feasible option.

2.1. Algae as a Bioenergy Source

Algae can also be used to generate energy in several ways. Thus, microalgae can provide feedstock for renewable liquid fuels such as biodiesel and bioethanol. The idea of using microalgae as a source of biofuel is not new, but it is now being taken seriously because of the rising price of petroleum and, more significantly, the emerging concern about global warming that is associated with burning of fossil fuels. Algal biomass contains three main components: carbohydrates, proteins, and lipids/natural oils. Microalgae grow very quickly compared to terrestrial crops. They commonly double in size every 24 hours. During the peak growth phase, some microalgae

can double every 3.5 hours (Chisti 2007). Microalgae have very short harvesting life that are capable to allowing multiple and continuous harvesting of biomass year round unlike oilseed crops. Microalgae require less freshwater for cultivation than terrestrial plants. Microalgal cultivation can occur on non-arable land, in brackish water thus reducing strain on resources required for the production of food crops whilst reducing other environmental effects. There is no need for use of chemicals such as herbicides or pesticides thus reducing costs and environmental impacts (Rawat 2013). In addition to producing biofuel, algae can also be explored for a variety of other uses, such as fertilizer, pollution control, and human nutrition. Certain species of algae can be land-applied for use as an organic fertilizer, either in its raw or semi-decomposed form (Thomas 2002).

2.2. Algae Mass-Cultivation Systems

Most microalgae are strictly photosynthetic, i.e., they need light and carbon dioxide as energy and carbon sources. This culture mode is usually called photoautotrophic. Some algae species, however, are capable of growing in darkness and of using organic carbons (such as glucose or acetate) as energy and carbon sources. After selecting the microalgae strain to obtain the product of interest, it becomes necessary to develop a whole range of bioprocesses that make viable its commercialization. Thus, the design and optimization of adequate bioreactors to cultivate these microorganisms is a major step in the strategy that aims at transforming scientific findings into a marketable product. Despite of many possible applications, only a few species of algae are cultured commercially because of poorly developed microalgal bioreactor technology. Cultivation systems of different designs attempt to achieve these characteristics differently.

Open ponds are the oldest and simplest systems for mass cultivation of microalgae. In this system, the shallow pond is usually about one-foot deep, and algae are cultured under conditions identical to their natural environment. Open ponds are the oldest and simplest systems for mass cultivation of microalgae. In this system, the shallow pond is usually about one-foot deep, and algae are cultured under conditions identical to their natural environment.

Figure 1. Open pond system

Enclosed photobioreactors have been employed to overcome the contamination and evaporation problems encountered in open ponds (Molina Grima et al. 1999). These systems are made of transparent materials and are generally placed outdoors for illumination by natural light. The cultivation vessels have a large surface area-to-volume ratio. Despite the relative success of open systems, recent advances in microalgal mass culture require closed systems, as many of the new algae and algal high-value products for use in the pharmaceutical and cosmetics industry must be grown free of pollution and potential contaminants such as heavy metals and microorganisms.

Figure 2. Photobioreactor Systems

Tubular PBRs can be horizontal/serpentine, near horizontalverticalinclined and conical-shaped. Microalgae are circulated through the tubes by a pump, or preferably with airlift technology. Generally these PBR systems are relatively cheap, have a large illumination surface area and have fairly good biomass productivities.

The advantages of enclosed photobioreactors are obvious. They can overcome the problems of contamination and evaporation encountered in open ponds (Molina Grima et al. 1999). Disadvantages include fouling, some degree of wall growth, dissolved oxygen and CO2 along the tubes, and the pH gradients that lead to frequent re-carbonation of the cultures, which would consequently increase the cost of algal production.

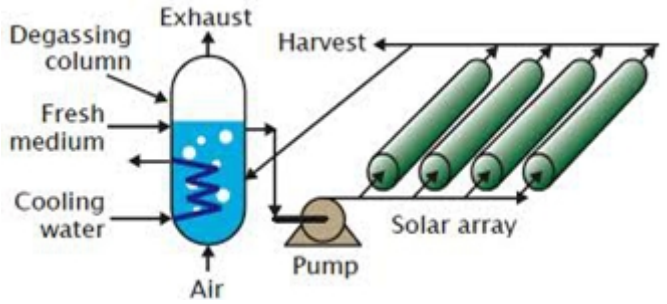

Figure 3

2.3.Harvesting methods

Given the relatively low biomass concentration obtainable in microalgal cultivation systems due to the limit of light penetration (typically in the range of 1-5 g l-1) and the small size of microalgal cells (typically in the range of 2-20 μm in diameter), costs and energy consumption for biomass harvesting are a significant concern that needs to be addressed properly.

Flocculation can be used as an initial dewatering step in the bulk harvesting process that will significantly enhance the ease of further processing. This stage is intended to aggregate microalgal cells from the broth in order to increase the effective ‘‘particle’’ size.

Some strains naturally float at the surface of the water as the microalgal lipid content increase. Although flotation has been mentioned as a potential harvesting method, there is very limited evidence of its technical or economic viability.

Centrifugation involves the application of centrifugal forces to separate microalgal biomass from growth medium. Once separated, microalgae can be removed from the culture by simply draining the excess medium.

Filtration is the method of harvesting that has proved to be the most competitive compared to other harvesting options. There are many different forms of filtration, such as dead end filtration, microfiltration, ultra filtration, pressure filtration, vacuum filtration and tangential flow filtration.

3. CONCLUSION

The production cost of algal oil depends on many factors, such as yield of biomass from the culture system, oil content, scale of production systems, and cost of recovering oil from algal biomass. Currently, algal-oil production is still far more expensive than petroleumdiesel fuels. microalgal biodiesel is technically feasible. It is the only renewable biodiesel that can potentially completely displace liquid fuels derived from petroleum. Algal biofuel is an ideal biofuel candidate which eventually could replace petroleum-based fuel due to several advantages, such as high oil content, high production, less land, etc. Technological developments, including advances in photobioreactor design, microalgal biomass harvesting, drying, and processing are important areas that may lead to enhanced cost-effectiveness and therefore, effective commercial implementation of the biofuel from microalgae strategy.

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Comparative analysis of harmonic distortions from variable frequency induction motor drives

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Abstract: The undoubted advantages of induction motor drives fed by frequency inverters, for energy efficiency improvement inclusive, have led to their increasing utilization in practice. Their application results in generation of harmonic distortions that have an adverse effect on electromagnetic compatibility. This paper presents a study of the degree of harmonic current distortions in the electric supply system caused by variable frequency drives of different manufacturers at varying loads. It has been established how the values of the total harmonic distortion and the crest factor change at no load and at rated load applied to the studied frequency inverters. As a result of the performed analysis of the generated harmonics, the most pronounced harmonics of the power line current have been determined, which must be filtered in order to prevent disturbance of the electromagnetic compatibility.

Keywords: energy efficiency of variable frequency drives, current harmonics, total harmonic distortion, crest factor

1. INTRODUCTION

In practical applications, the number of variable induction motor drives fed by frequency inverters is continuously increasing. While such drives possess a series of undoubted advantages, they also cause electric power quality deterioration as it is regulated in the Standard BDS **EN 50160:2003** [2].

The use of asynchronous electric drives with frequency inverters leads to increased energy efficiency which stands as a priority for modern economic development and complies with Directive 2006/32/EC of the European Parliament and of the EU Council. It lists sample measures on energy efficiency improvement in the final consumption of electricity by motors and drives. The said measures include increasing the use of electronically controlled drives, adjustable variable speed drives, and high-efficiency electric motors [4].

One of the problems arising during the operation of controllable asynchronous drives is related to the so-called electromagnetic compatibility with the power supply system. Variable speed drives are consumers with nonlinear current-voltage characteristics, which draw non-sinusoidal current and as a result higher-order current harmonics are generated in the electric supply system. These produce voltage drops in the resistance of the other components in the electric supply system which overlap the fundamental voltage sine wave and cause distortion of the sine waveform.

The possibility of generation of harmonic voltage distortions in the electrical grid depends on the impedance of the system and on the power of the power supply transformer and of the nonlinear load. The higher the power of the transformer, the smaller distortions it causes. When the power of adjustable asynchronous electric drives is smaller than (10...15)% of the power of the transformer it is assumed that the inverters will pose no problem with the electric supply system operation.

Since January 1996, the electromagnetic compatibility Directive 89/336/EEC has been effective in the European Union. The regulatory framework stipulating the requirements to electromagnetic compatibility of adjustable drives is given in the Standard EN 61800-3 [3]. The compliance with the requirements of the said Standard stands as a minimum condition for free trade of electronic power converters. Under this Standard, manufacturers are required to provide, in the product documentation or upon request, the percentage ratio of current harmonics with successive numbers up to, as a minimum, the 25th one in relation to the fundamental component, at rated conditions.

Frequency inverter manufacturers include warnings in the operation manuals that the direct switching of inverters to the supply grid without the use of filters may result in power grid disturbances. Furthermore, the types of filters to be used for a

specific frequency inverter are also specified. Other manufacturers market frequency inverters with power chokes.

The purpose of this study is to produce a comparative analysis of the degree of harmonic current distortions in the electric supply system when an induction motor is fed by different frequency inverters with a changing load.

2. PRESENTATION

The experimental studies are conducted using a three-phase induction motor type 1LA9083-2 KA60 with rated characteristics: 1,1kW; 400/690V; 2,1/1,23A; 2860min-1; energy efficiency class EEF1, manufactured by Siemens. The induction motor is powered by two identical technical data frequency inverters of leading manufacturers of converting equipment, provisionally designated as **F1** and **F2**. A pre-set separately excited DC generator serves as a load.

All tests are carried out at 380V rated supply voltage of the induction motor and 50 Hz current frequency, without the use of line filters or other devices to attenuate the effect of the higher-order harmonics.

The measurements at the variable frequency drive (VFD) input are performed using a three-phase power and quality analyser Qualistar **C.A.8334** with accuracy class for voltage and currency measurements ±0,5%, manufactured by the French company Chauvin Arnoux.

Figure 1. shows the structural diagram of the VFD used in the experiments. They are of the most common type of frequency inverters with an intermediate DC link. Each inverter also includes an uncontrollable rectifier, a DC link and an inverter operating by the principle of pulse-width modulation.

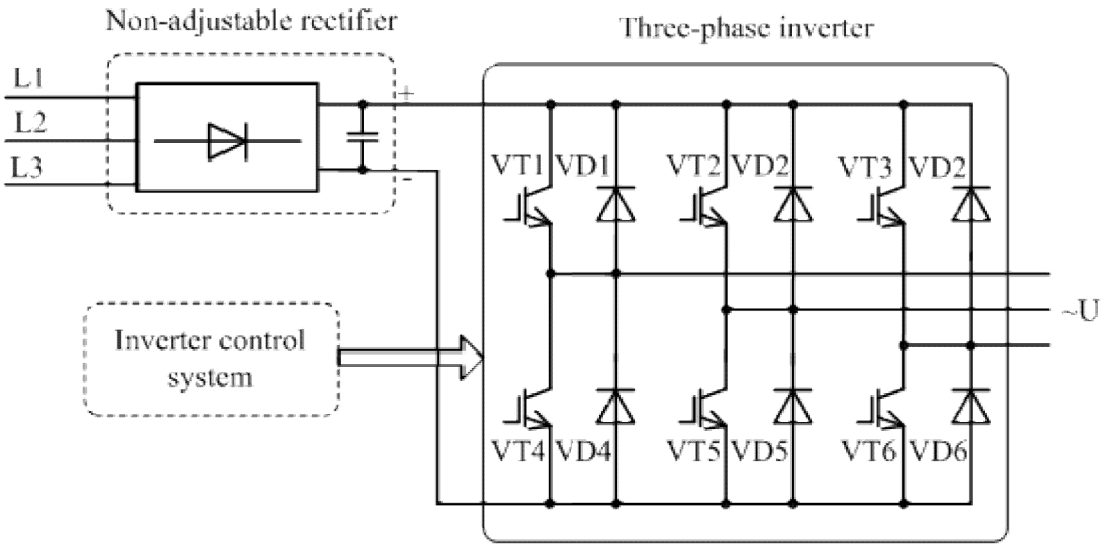
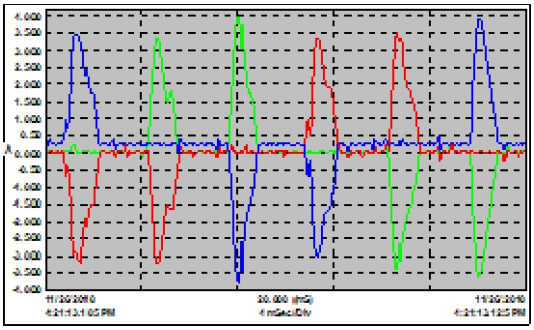


Figure 1. Structural diagram of a frequency inverter with an intermediate DC link and pulse-width modulation

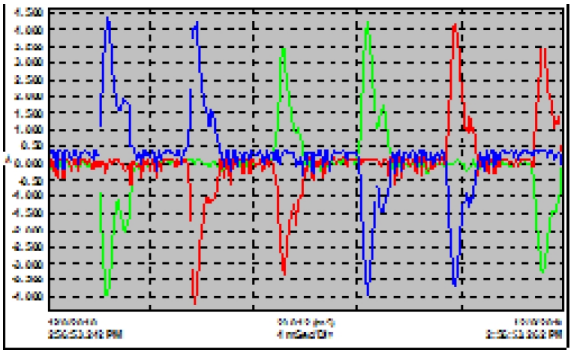
3. RESULTS AND DISCUSSION

In the frequency inverters used in this experiment, the mains supply voltage is first rectified by an uncontrollable three-phase 6-pulse bridge rectifier, whereupon the rectified voltage is filtered through a capacitor in the intermediate DC link. By applying pulse-width modulation the inverter transforms DC voltage into AC voltage. The amplitude and frequency of the AC (output) voltage change by a preset law that serves to control the speed of induction motors.

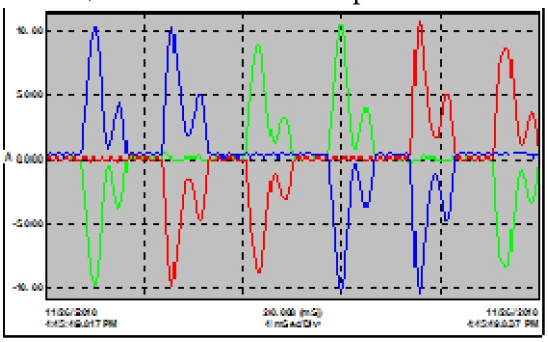
Figure 2 shows the oscillograms produced by the analyser for the three-phase input current supplied to the two frequency inverters, at no-load and full rated load of the induction motor.



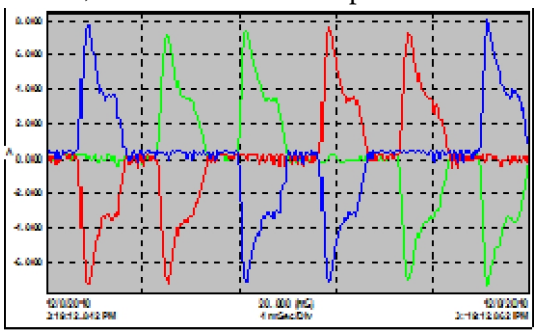
a) at no load, to the input of F1



b) at no load, to the input of F2



c) at rated load, to the input of F1



d) at rated load, to the input of F2

Figutre 2. Oscillogram of the input current supplied to frequency inverters F1 and F2

As can be seen in Figure 2, current flows through each phase for a very short period of time (1,5 ... 2,0)ms and its waveform differs significantly from the sine waveform. Therefore, there are harmonics passing through the power line. The current consumed in each phase consists of two discrete pulses per half-period and these have a very high peak value. The pulses occur when the diodes of the respective phase are "on" and the capacitor voltage is lower than the the DC busses voltage. As a result, a process of charging the capacitor takes place. At every one moment two diodes from the different phases are "on", one of the diodes being from the cathode group with highest potential of the anode, and the other from the anode group with lowest potential of the cathode.

For sinusoidal magnitudes, the ratio between the effective and maximum values is 1,41. From the obtained results (Figure 2) it is evident that the current peaks reach values of up to 4A for **F1**, and 4,5A for **F2** at no-load condition, with an effective value of the current drawn from the power line 1A, i.e. current peaks are about 4 times higher and express a non-sinusoidal character.

For evaluation of the non-sinusoidal character of the current and voltage two basic indices [1] are used. The first one is the peak (crest) factor of the current CF_I or of the voltage CF_U which represents the ratio of the peak value of the current (or voltage) I_{max} (U_{max}) to its effective value, with consideration of the influence of the harmonics. The employed three-phase analyser measures the values of the harmonics up to the 50th one, i.e. k=50, and the crest factor is calculated by the formula:

$$CF_I = \frac{I_{max}}{\sqrt{\sum_{\kappa=1}^{50} I_\kappa^2}}, \quad (1)$$

where I_k is the effective value of the k-order harmonic.

The other index is the so-called non-sinusoidality known also as Total Harmonic Distortion Factor THD_I:

$$THD_I = \frac{\sqrt{\sum_{\kappa=2}^{50} I_\kappa^2}}{I_1} 100, \quad (2)$$

where I_1 is the effective value of the first (fundamental) harmonic.

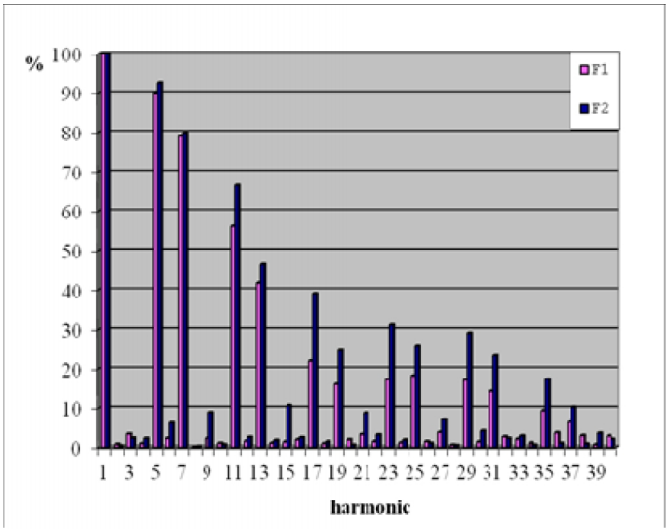
Table 1 gives the computed average values of the current consumption (I), the total harmonic distortion of voltage (THD_U) and of current (THD_I), the crest factor of voltage (CF_U) and of current (CF_I), obtained from the measurements in the three phases.

Table 1. Results for the indexes characteristic of the non-sinusoidality of current and voltage

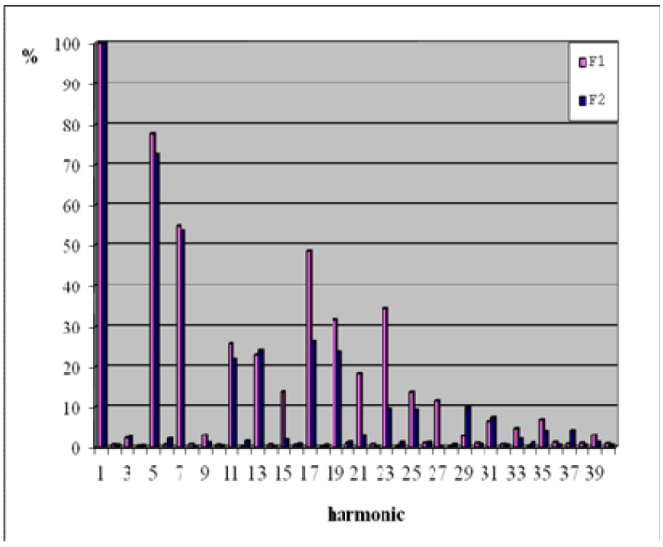
Quantity	F1		F2	
	No load	Rated load	No load	Rated load
I, A	1,12	3,16	1,09	2,77
THD_I, %	152,45	127,71	160,15	103,77
THD_U, %	1,9	1,85	1,57	1,60
CF_I	3,22	3,28	3,84	2,81
CF_U	1,39	1,39	1,39	1,4

For the first frequency inverter designated as F1, the crest factor almost never changes at no load or at rated load, while for the second one, F2, it reduces from 3,84 to 2,81, i.e. by 27%.

At no load, the total harmonic distortion of current (THD_I) is approximately 150% for **F1** and 160% respectively for **F2**. The total harmonic distortion of the current consumed by inverter **F2** is 5% higher compared to that of **F1**.



a)



b)

Figure 3. Spectral composition of the input current to frequency inverters **F1** and **F2** at: a) no load applied to the induction motor; b) rated load applied to the induction motor

In the situation of rated load, it is the opposite. The total harmonic distortion in **F1** is 23% higher than in **F2**. As a whole, in both frequency inverters, with the load changing from no load to full rated load, the total harmonic distortion diminishes in the process by 16% in F1 and 35% in **F2**, respectively.

Figure 3 shows the current harmonics for the two different inverters in order to make their comparison easier.

In the electric supply system are generated current harmonics of order $n = 6k \pm 1$ in the case of 6 rectifying diodes, where k = 1, 2, 3 ... By applying symmetrical load to the three phases, the current drawn by the load does not include harmonics that are multiples of 3, and consists of straight harmonics $n = 6k+1$ and subharmonics $n = 6k-1$.

As is seen in Figure 3, for both frequency inverters the most pronounced are the odd harmonics with harmonic numbers 5, 7, 11, 13, 17, 19, etc. By continuously applying load to the induction motor, the 11^{th} and 13^{th} harmonics are substantially reduced, by about 30% and 20% respectively.
The total harmonic distortion (THD_U) and the crest factor (CF_U) of the supply voltage do not change after switching on the speed drive because the power of the drive (1,1 kW) is much lower than the power of the power supply transformer (400 kVA).

4. CONCLUSION

Frequency inverters draw from the mains strongly non-sinusoidal current with a high total harmonic distortion factor. At no-load condition, the current pulses have a width of about (1,5 ... 2) ms. This problem is the subject of previous research but no comparative analysis has been done on how the induction motor loading influences the current pulses width, the total harmonic distortion and crest factor for the current.
The degree of total harmonic distortion of current depends on the load applied to the induction motor. It reduces with the increase of the load since the current pulses increase in width. For frequency inverter **F1**, THD_I is reduced from 152% at no load to 128% at a load corresponding to the nominal power, while power supply

through frequency inverter **F2** results in significantly higher reduction, from 160% down to 103%.

The crest factor for the current, as the loading changes from no load to full rated load, remains almost unchanged for the frequency inverter **F1** while for **F2** it diminishes significantly.

It is necessary to use filters at the input of the frequency inverters to suppress the higher-order harmonics of the current, with a maximum efficiency in the range of the 5^{th} to the 7^{th} harmonics which have the highest amplitudes.

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Power Quality Analysis before and after the connection of Biogas Power Plant Mala Branjevina

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Abstract: The biogas power plant is installed in Eastern Croatia with a rated power of 2x1 MW. Power quality indices of the biogas power plant Mala Branjevina 2 were measured before and after the connection to the distribution network. The biogas power plant is connected to the distribution network using a T-connection on 10 kV overhead line feeders connected to TS 35/10 kV Laslovo and TS 35/10 kV Cepin. Power quality indices for the biogas power plant were measured using the Fluke 1760 Three-Phase Power Quality Analyzer (class A), and were presented according to the Croatian standard HRN EN 50160/2010 which is in accordance with the European standard EN 50160. Short circuit ratio a between three-phase short circuit at the point of common coupling (PCC) and the rated power of the biogas plant were also checked in accordance with the HEP National grid code. In addition, the influence of the biogas power plant on the distribution network was also analyzed. Results show that all the parameters of the supply voltage satisfy limits determined by the Croatian standard HRN EN 50160:2010. Futhermore, harmonic distortion of voltage waveform is even lower after the plant connection.

Keywords: Biogas power plant, distribution network, power quality, power quality indices, measurements, HRN EN 50160 norm.

1. INTRODUCTION

The electrical power system provides the production and delivery of electrical energy in sufficient quantities to areas that need electricity through a grid. Electrical energy is a product whose quality depends not only on the production units, but also on the way it is being used at any instant by the equipment of multiple users. Electrical equipment has become progressively complex due to the use of microprocessors and electronic devices which are more sensitive to deviations from sinusoidal supply voltage (Nikolovski, Klaic & Novinc, 2004). For those reasons it is necessary to continuously measure and analyze power quality parameters in the key points of the power system. The main parameters of supply voltage are: voltage magnitude, frequency, waveform and symmetry (if multiphase systems are used). According to the Eurpean standard EN 50160:2010, power quality analysis typically includes the following properties of supply voltage:

- voltage dips and interruptions,
- harmonics and interharmonics,
- temporary overvoltages,
- swell,
- transient overvoltages,
- voltage fluctuations,
- voltage unbalance,
- power frequency variations,
- DC in AC networks,
- signaling voltages.

Power quality is the study of powering and grounding electronic systems so as to maintain the integrity of the power supplied to the system (Kusko & Thompson, 2007). The European standard EN 50160 (also adopted in the Croatian standard as HRN EN 50160:2010) gives the main voltage characteristics supplied by the public distribution system at the customer's supply-terminals in public low voltage and medium-voltage distribution systems under normal operating conditions (EN 50160:2010). In order to determine the influence of the biogas power plant on the distribution network, power quality indices of the biogas power plant Mala Branjevina 2 were measured before and after its connection to the distribution network.

2. TECHNICAL DATA OF THE POWER PLANT

The biogas power plant Mala Branjevina is installed in Eastern Croatia with a rated power of 2x1 MW. It consists of two equal production units, each containing a STAMFORD generator with a rated power of 1 MW. The biogas power plant is connected to the distribution network using a T-connection on 10 kV overhead line feeders connected to TS 35/10 kV Laslovo and TS 35/10 kV Cepin. In this paper, the influence of the second production unit, Mala Branjevina 2, on the distribution network is presented.

Figure 1. Biogas power plant Mala Branjevina

3. POWER QUALITY MEASUREMENT AND RESULTS

According to the Croatian grid code for 10 kV networks (Croatian Electric Utility HEP), the ratio between short circuit power of the grid at the point of common coupling and rated power of the power plant planned to be connected has to be higher than 1000 ($S''k/Sn > 1000$). If the ratio is below 1000, power quality analyses before and after the plant connection have to be performed. In order to calculate short circuit power of the distribution grid at the plant connection point, a computer model created in DigSILENT PowerFactory software is used (Fig. 2).

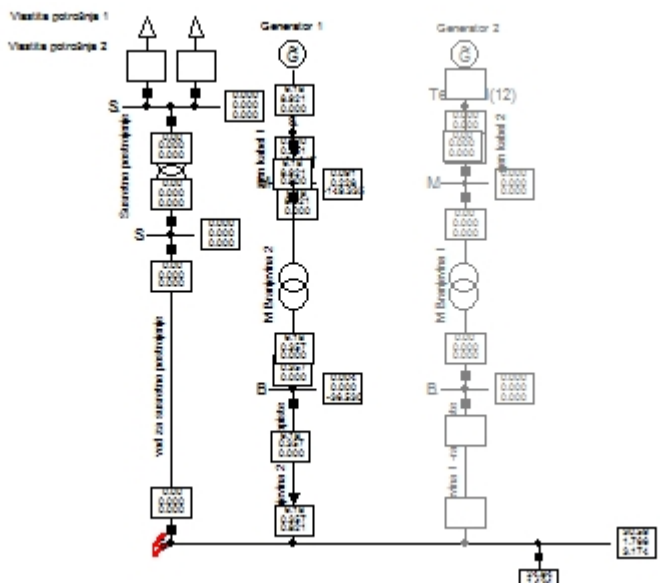

Figure 2 Part of the computer model made in DigSILENT PowerFactory software

The calculated short circuit power is 30.59 MVA, the rated power of the generator is 1.4 MVA according to which the ratio amounts 30.59/1.4 = 21.7 which is below the required 1000. For those reasons, the power quality measurements were taken at the 10 kV switchyard of the power plant Mala Branjevina 2 in two periods:

1 week before the connection of the plant to the grid – from 7th till 14th March 2012,

2 week after the connection of the plant to the grid – from 3rd to 10th April 2012.

In the measurement campaign the Fluke 1760 Three-Phase Power Quality Analyzer (class A) was used.

3.1. Power quality measurement results before the connection of the plant

In this subsection, results of the power quality measurement that were carried out in the week before the connection of the plant are presented and briefly commented. Fig. 3 presents the summarized measurement results of power quality indices for the first measuring period.

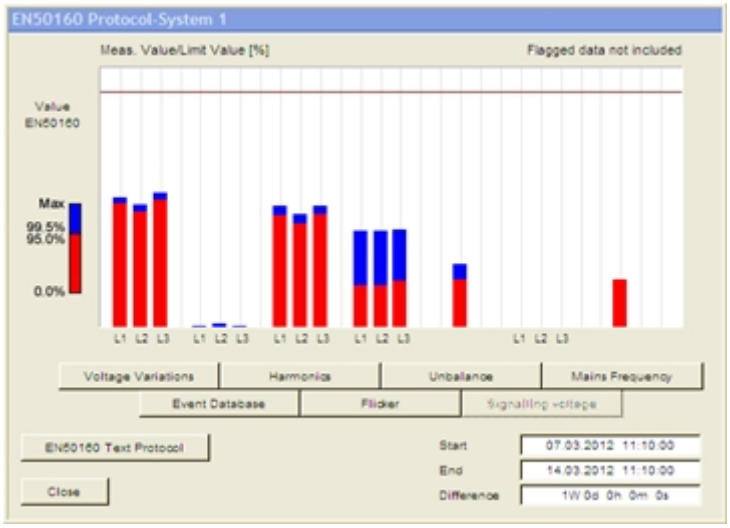

Figure 3 Summarized power quality indices according to the standard HRN EN 50160:2010

Fig. 4 shows the average RMS voltage value before the plant connection.

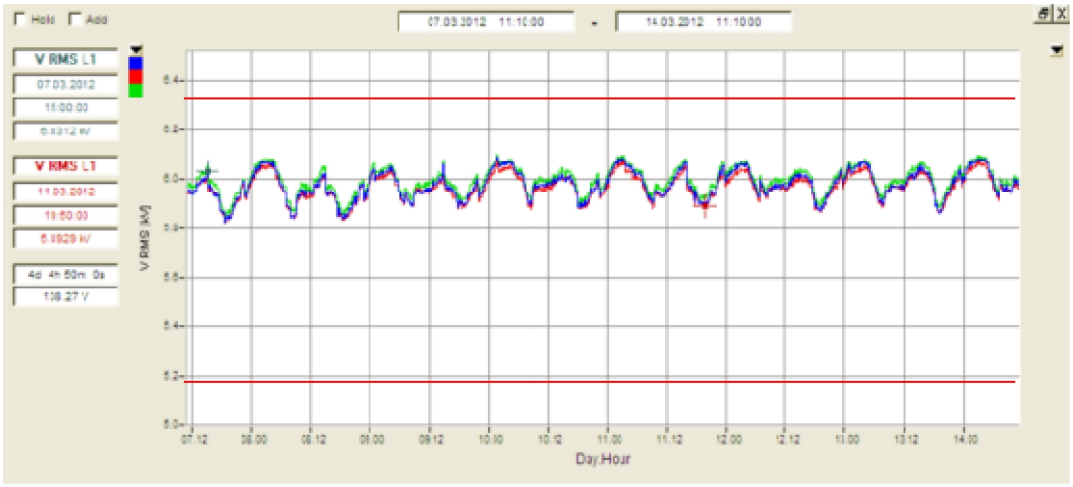

Figure 4 Average RMS voltage value before the plant connection

The obtained results show that all indices are within the limit values of the standard HRN EN 50160:2010. As can be seen from the Fig. 4, average values of RMS voltage are within the range of +/- 10% of rated voltage required by the standard HRN EN 50160:2010.The deviation of the voltage and current waveforms from sinusoidal is described in terms of waveform distortion, i.e. harmonic distortion (De

La Rosa, 2006). In order to describe harmonic distortion of the signal, the well-known Total Harmonic Distortion (THD) index is used. Fig. 5 shows THD of voltage prior to the plant connection. The measured value of voltage THD is below 8% which is stated in the standard HRN EN 50160:2010. The spectral analysis of the voltage signal is shown in Fig. 6. The dominant voltage harmonics recorded through the measurement campaign are of the odd order, especially the 3rd, 5th, 7th and 9th. All harmonic values are in accordance with the standard HRN EN 50160:2010.

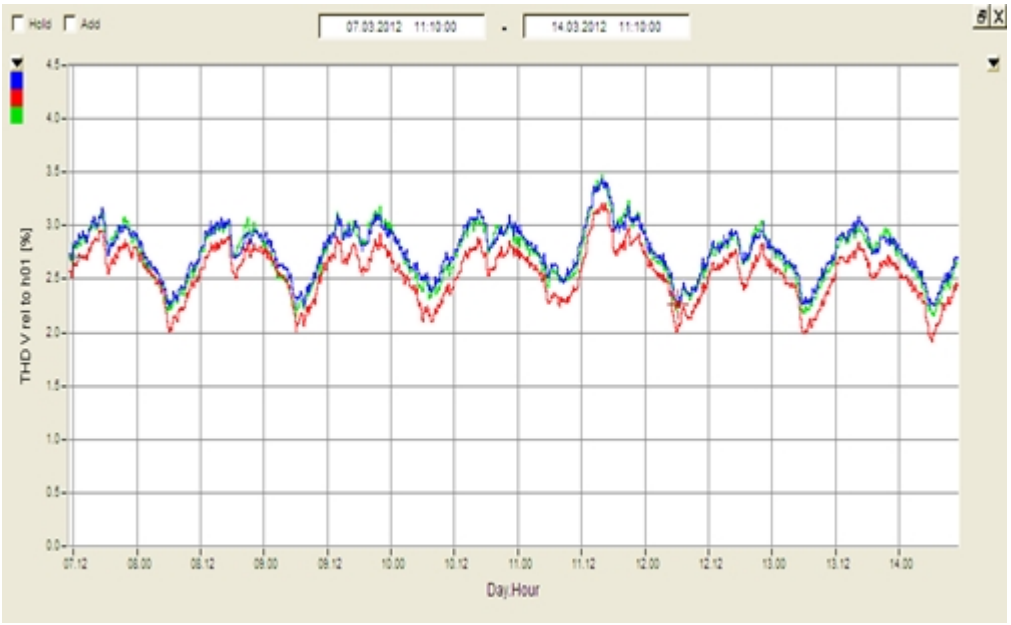

Figure 5 THD of voltage before the plant connection

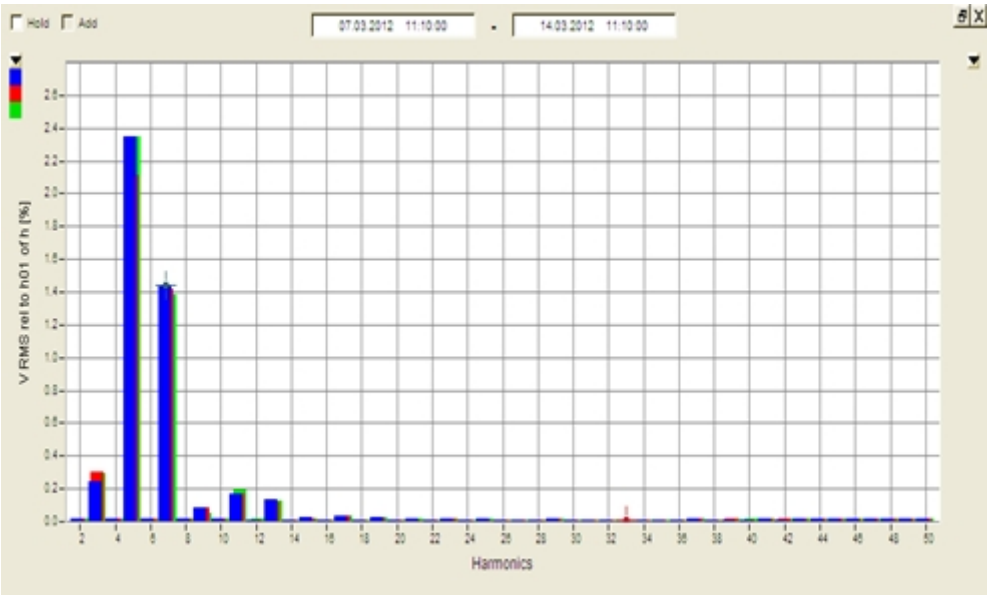

Figure 6 Harmonic spectrum of the voltage signal before the plant connection

3.2. Power quality measurement results after the connection of the plant

In this subsection, results concering power quality measurements that were carried out in the week after the connection of the plant are presented and briefly commented. Fig. 7 presents the summarized measurement results of power quality indices for the second measuring period. All power quality indices are within the limit determined by the standard HRN EN 50160:2010.

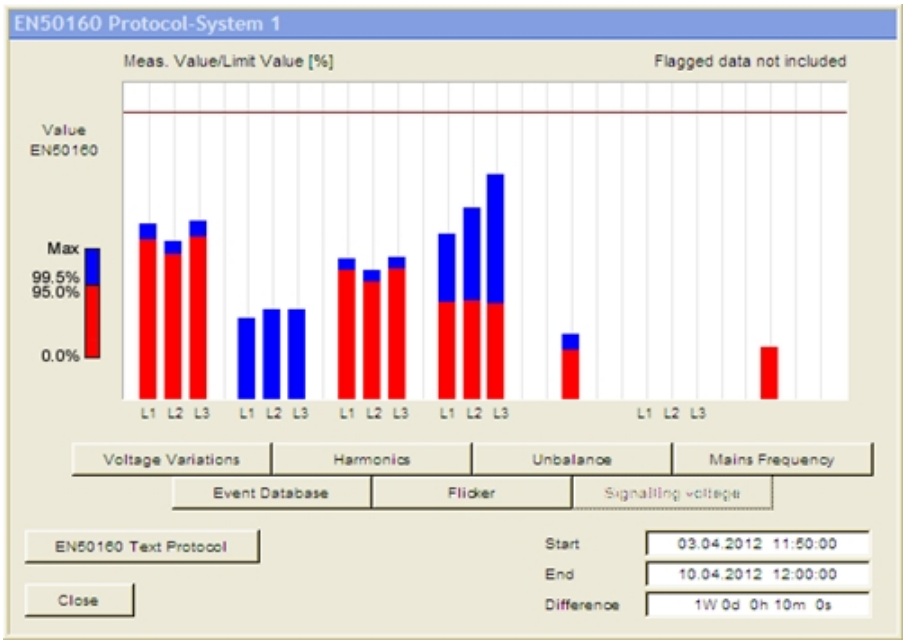

Figure 7 Summarized power quality indices according to the standard HRN EN 50160:2010 after the power plant connection

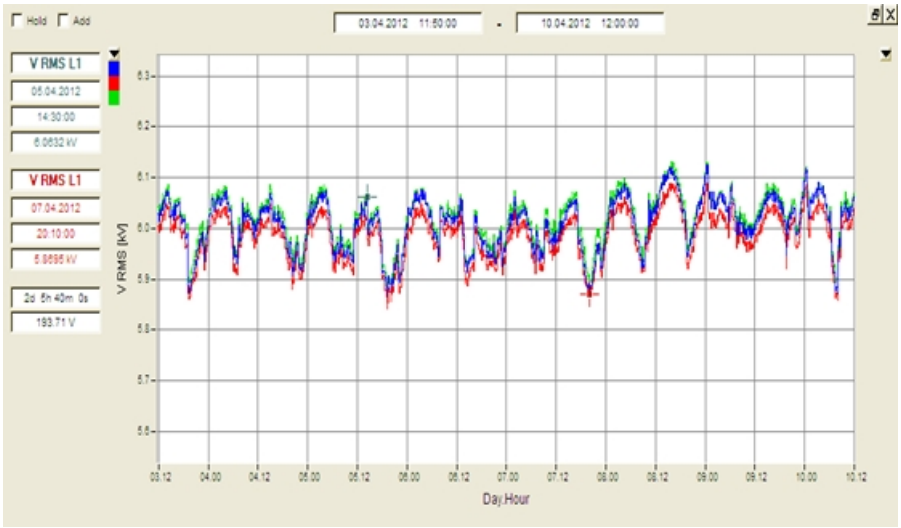

Figure 8 Average RMS voltage value after the plant connection

Fig. 8 shows the average value of RMS voltage after the plant connection. Average values of the RMS voltage are again within the range of +/- 10% of rated voltage

and it can be concluded that the plant does not have a negative impact on this power quality index.

Fig. 9 shows THD of voltage after the plant connection. According to the standard HRN EN 50160:2010, the permitted contribution of the plant to the value of the THD index recorded before the connection has to be below 2%. As presented in Fig. 9, the value of the THD index is even lower than in the case before the plant connection. Fig. 10 shows the harmonic spectrum of the voltage signal after the plant connection. The harmonic values are lower after the plant connection.

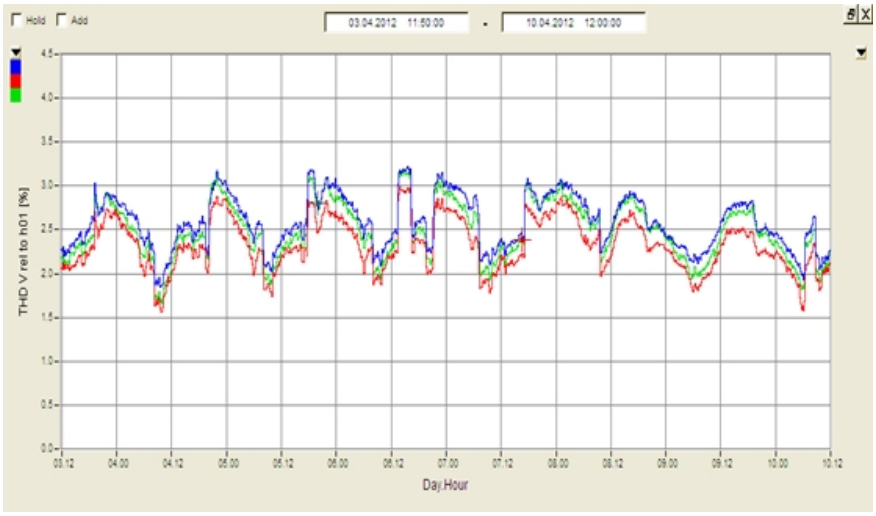

Figure 9 THD of voltage after the plant connection

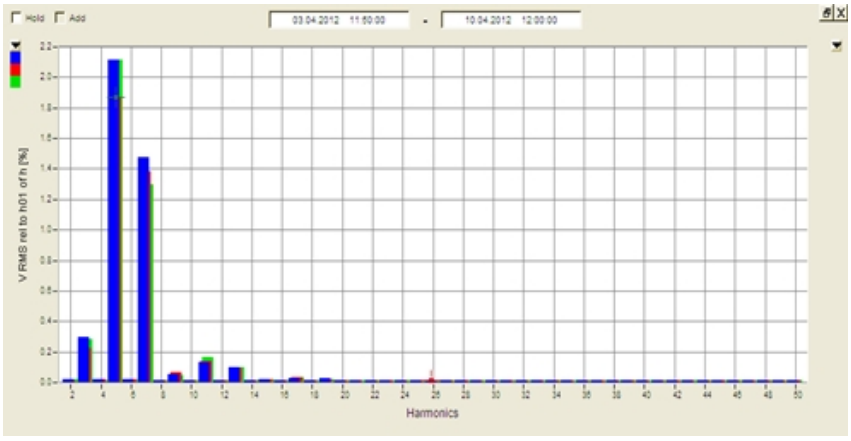

Figure 10 Harmonic spectrum of the voltage signal after the plant connection

4. CONCLUSION

In this paper, the impact of the biogas power plant Mala Branjevina 2 on power quality indices of the distribution network is presented. The calculated ratio of short circuit power of the grid at the point of common coupling and the rated power of the power plant is below the required value determined in the Croatian grid code. Accordingly, power quality analyses before and after the plant connection have to be carried out. Analysis of the measured power quality indices before and after the conection of the biogas power plant Mala Branjevina 2 shows that all the parameters of the supply voltage satisfy limits determined by the Croatian standard HRN EN 50160:2010 which is in accordance with the European standard EN 50160. Harmonic distortion of voltage waveform is even lower after the plant connection because biogas power plant presents new power source in consumption area. Genarated voltage value has simetrical sinusoidal waveform which decreases harmonic distortion in observed consumption area. Evacuation of the generated power in Mala Branjevina 2 is conducted without any problems.

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Evaluation on Security of Energy Supply for Macedonia

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Abstract: In this study energy circumstance of Macedonia was analized in order to evaluation for security of energy supply. Firstly, energy resources and power plants were investigated.and tabulated. SWOT analysis applied with strengths, weaknesses, opportunities and threats (SWOT) concepts which were written for the country regarding geographical and strategical position, energy resources and economical situation of the country. As known that, SWOT analysis may be used in decision-making situation when a desired end-state (objective) has been defined. Internal and external analysis applied and some suggessions composed as the conclude evaluation of SWOT analysis for Macedonia energy analysis.

Keywords: energy supply, energy demand, macedonia, swot analysis,

1. INTRODUCTION

Energy, is one of the most important factors that determine the international competitiveness of countries. The rising of the energy demand in the world and limited energy sources increases the importance of the energy policies of the countries (Tuğrul, 2011). For this reason, who took the management of the country and energy sector, are responsible to provide the energy needs of society and economy, adequate, high-quality, continuous, low-cost and environmentally friendly.

According to the Green Book entitled "A European Strategy for The Security of Energy Supply' prepared by European Commission, Security of Energy Supply is

defined as: for the good of the whole society and a well-functioning economy with the objective of sustainable development for all consumers to provide physical access of energy products in each market price.
At the beginning of the priority issues to be considered when determining energy policies, is to determine healthy and scientifically the potential of the country's energy resources. After the identification of the potential of the country's energy resources; how to develop mentioned energy resources, in which areas domestic or foreign private sector contribution would be needed, whether imports would be necessary and in such issues strategies can be developed. İf in some circumstances import is unavoidable or should be used periodically; resource diversity should be considered as one of the most important energy policy requirement.
In this study, SWOT Analysis applied for Macedonia in the view of energy supply security. For this purpose, energy statistics of the Macedonia were analyzed firstly. .

2. SWOT ANALYSIS

SWOT Analysis is a strategic planning method used to evaluate the *Strengths, Weaknesses, Opportunities,* and *Threats* involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favourable and unfavourable to achieving that objective (ENEF, 2010). Users of SWOT analysis need to ask and answer questions that generate meaningful information for each category (strengths, weaknesses, opportunities, and threats) to make the analysis useful and find their competitive advantage (Humphrey A., 2005). Figure 1 shows the scheme of SWOT analysis.

Figure 1. Scheme of SWOT Analysis

SWOT analysis may be used in any decision-making situation when a desired end-state (objective) has been defined. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve that objective. SWOT analysis was applied for evaluation of Mecadonia energy supplies.

2.1. Energy Analysis for Macedonia

Macedonia is located in the middle of the Balkans and in the southeast of Europe having 25,333 km^2 area. The borders are, Serbia to the north, Bulgaria to the east, Greece to the south and Albania to the west. Macedonia has a GDP of USD 9,521 million and a population of approximately 2.04 million (Reneuer, 2010, A.F. Tieman, 2010).

Macedonia is an agricultural country. Therefore, 40% of the population's occupation is agriculture. 95% of the imports is consisting of industrial products. GDP - real growth: %4 (2006) and inflation rate (in consumer prices) is %3 (2006). Active work force is approximately 880,000 (2006) and unemployment rate is 35% (2006). Coal, metallic chromium, lead, zinc, ferronickel, textiles, wood products, tobacco are main industrial sectors and industrial production growth rate is %3.5 (2006) (A.F. Tieman, 2010).

The Republic of Macedonia is poor in primary energy resources. There are two major open pit coal mines that supply two thermal power plants (TPPs) (TPP Bitola and TPP Oslomej), and two smaller open pit mines that produce lignite for the industry and other sectors. The coal deposits of the mines adjacent to the power plants are of very low heat value (lignite). Their capacities are limited and the plants are due for retirement in about 10 years (Energy Profile Macedonia). Figure 2 shows the performance of thermal plants

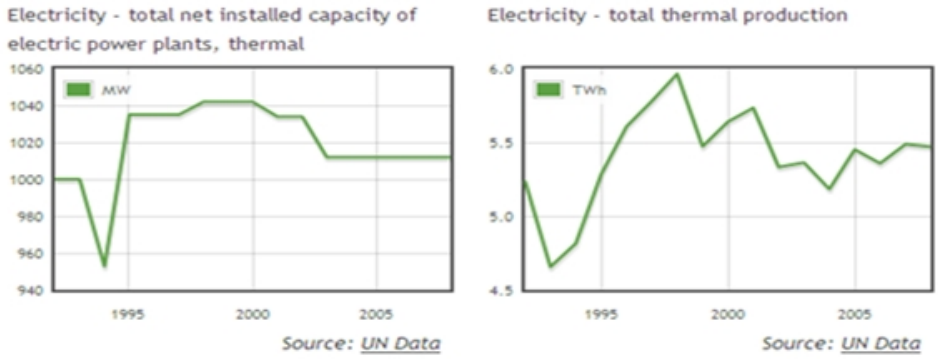

Figure 2 Performance of thermal plants in Mecedonia (http://www.reegle.info/countries/macedonia-fyr-energy-profile/MK)

Macedonia has limited hydro potential. Electricity production potential from the existing and future hydro power plants (HPPs) is estimated at 6500 GWh/year. Average annual production from the existing HPPs is approximately 1200 GWh/year with installed capacity of 540 MW. Figure 2 shows the performance of thermal plants

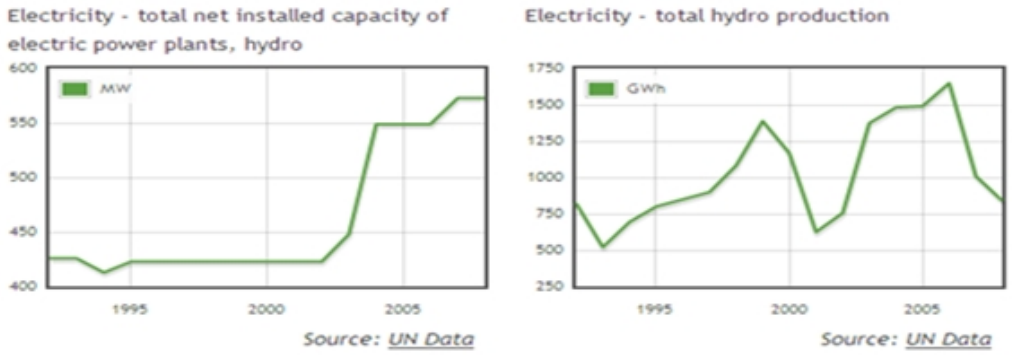

Figure 3 Performance of hydro-power plants Mecedonia (http://www.reegle.info/countries/macedonia-fyr-energy-profile/MK)

There are no domestic sources for production of natural gas and the supply of natural gas comes from imports. The gas transmission network has not been extended with an appropriate distribution network. Currently, only a handful of industrial facilities and the district heating company in Skopje use natural gas. Over the past 10 years the annual utilization of the pipeline has been between 8 and 12%. Wood is used mostly for space heating, and only a limited number of industrial facilities use wood waste as a fuel substitute. The use of geothermal water (with a relatively low temperature) is limited to district heating in a small city in the eastern part of the country, and for space heating of greenhouses in the agricultural sector.
Power balance is the key determinant of energy balance and also for in Macedonia. Energy balance data is presented in Table 1. Installed power generation capacity in Macedonia is 1450 MW, comprising approximately 60 percent thermal and 40 percent hydro plant. (ref: Ministry of Economy).

Table 1. Energy Balance of Macedonia (MEM,2010).

Supply and consumption	Coal	Crude oil	Petroleum products	Gas	Hydro	Electricity	Heat
Production	1209				101		
Imports	105	818	376	54		10	
Exports			-224				
Electricity plants	-1214		-99		-101	585	
CHP plants	-11		-18	-7			22
Heat plants	-15		-125	-35			170
Petroleum refineries		-991	952				
Industry sector	-99		-186	-6		-134	
Transport sector			-360			-2	
Other, including residential	-5		-115			-312	-66

Macedonia demand increases via developing of the country. Energy demand growth between years 1991-2008 in Macedonia is given Figure 4. Forecast power demand and supply are presented in Table 2.2 above. On the supply side, the table assumes that there are no new additions to capacity and that plant (specifically Bitola and Oslomej) is retired at current planned dates.

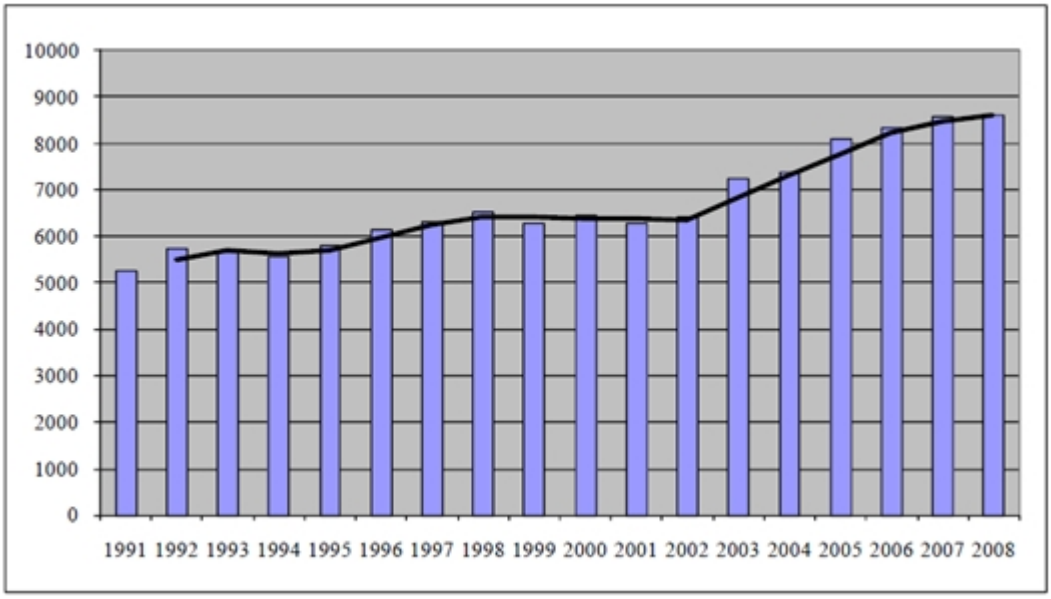

Figure 4 Energy demand growth between years 1991-2008 in Macedonia (Statement on Security of Supply, Republic of Macedonia, 2009).

Table 2. Supply-Demand Exchange by Years in Mecedonia

	1993	1998	2003	2008E	2013E	2019E
Power Demand[3] (GWh)	5690	6626	7222	8074	9780	12600
Power Production from existing plants[4] (GWh)	5136	6523	6272	5836	1230	1230
Power imports (GWh)	554	103	950	2238	8550	11370
% of Power Imported (Negotino out of operation)	10%	2%	13%	28%	87%	90%
% of Power Imported (Negotino in full operation)				14%	75%	78%

2.2. SWOT Analysis for Macedonia

Energy SWOT analysis may be used in any decision-making situation when a desired end-state (objective) has been defined. SWOT analysis arranged for Macedonia by using energy analysis that were given above. The scheme of SWOT analysis are given in Table 3 (S. Abdurahman, 2013).

Table 3 SWOT analysis for Macedonia

❑ STRENGTHS	❑ WEAKNESSES
✓ Geographical Position ✓ Potential of Renewable Energy Source ✓ Continuous Compliance with EU Regulations for Energy Policies and Standards ✓ Political Gains and Development Request	✓ Insufficient Local Energy Sources ✓ Low Electricity Prices ✓ High Energy Density ✓ Inadequate İnstitutional Capacity and Workforce ✓ Structure of the Heavy Tempo of Public
❑ OPPORTUNİTİES	❑ THREATS
✓ Regional Integration and a Common European Energy Market ✓ Energy and Climate Change Adaptation ✓ Presence of Geothermal Resources	✓ Increase in Oil Prices and a Global Cost of Capital ✓ Deficiency of Energy in Regional Level ✓ Environmental Obligations

3. RESULTS AND DISCUSSION

For the evaluation of SWOT analysis for Macedonia energy situation, internal and external analysis were applied.
Results with the internal analysis,

- Macedonia, with the appropriate geographical region, is not rich with the energy resources.
- Although it has renewable energy resources, there are institutional deficiencies.
- Although is adopted to comply to the EU standards, there is higher energy density.
- Despite it has a political achievement, there is a heavy-paced work.

Results with the external analysis:

- There is a compliance with the EU's common market, but EU is not rich with energy resources.
- The causing climatic problems and environmental liabilities of energy production (especially in the use of coal).
- Environmental liabilities make it necessary to orientate to the clean energy (Geothermal).

4. CONCLUSION

In this study, energy analysis of Macedonia evaluated with using SWOT analysis. As known that, SWOT analysis may be used in decision-making situation when a desired end-state (objective) has been defined. It can be concluded and suggested consideration for energy planning for Macedonia by the SWOT analysis results as;

- Giving priority to the own resources
- Use of advanced technology suitable for use in coal (eg, fluidized bed to use systems)
- To invest in geothermal energy
- Ensuring compliance with the EU
- Continuing with the compatibility with the EU systems
- Making the interconnected network fully compliant
- Giving priority to the movement of liberalization

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Is Bosnia and Herzegovina on a Sustainable Energy Development Path?

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Abstract: The energy sector is often credited for having major economic potential and being a driver of growth for Bosnia and Herzegovina (BiH). It has been proven that BiH possesses potential renewable energy sources, in particular hydro and biomass. However, the majority of energy production is conducted in outdated power plants and based on fossil fuels, resulting in environment pollution. In order to be energy sustainable, development of these processes should aim to reduce the environmental costs of energy production and use. The way in which BiH decides to use its major energy potentials will have significant implications for the future. This paper examines various aspects of sustainable development, starting from a review of development and energy intensity indicators.

The current state of the electrical energy sector is not sustainable due to the lack of investment into energy plants in the past, unrealistic plans for investment, inadequate policies and incentives for energy efficiency, and a lack of consistent policy to support renewable energy use. In addition to these problems, a state energy policy is virtually nonexistent and the state utilizes lower quality coal in thermal plants. Without a change in energy policies and consumption behaviour, as well as an increase in new investment with adequate financing models, BiH may soon face problems with its energy supply.

Keywords: sustainable energy development; energy intensity; energy efficiency; renewable energy sources; investments in energy.

1. INTRODUCTION

One of the most important natural resource is energy, as all things in nature and in everyday life require it. Also, energy has a significant positive long-term impact on economic growth and real output (Payne 2010). However, the relationship between energy and the environment is deep and complex. Studies show that the majority of environmental problems, in addition to agriculture and food consumption, are related to the use of fossil energy carriers (UNEP 2011). Consequently, the ways in which each country decides to meet growing demands for energy services will have significant implications for their futures. The demand for energy and its expenditure poses an immense challenge for Bosnia and Herzegovina (BiH) as well. Since BiH is the only net exporter of electrical energy in the Western Balkans and has significant potential of renewable energy sources, its energy has the most potential to be a driver of economic growth in the country. This paper tries to analyse what BiH is doing now and whether its current practices can guarantee that the energy systems will be on a secure and sustainable path in the future.

2. SUSTAINABLE ENERGY

The main solution for many energy use problems is often called 'sustainable energy development'. One of the definitions of sustainable development is: "A process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations" (UN 1987, pp. 42). As energy is the key resource and requirement for economic and social development, sustainable development is related to sustainable energy development. Unfortunately, the overall energy system is inefficient and only about a third of the world's energy input is converted into useful energy (Nakicenovic, Grubler & McDonald 1998). Secondly, the major portion of the current energy supply and use is based on fossil fuels and is, as a result, environmentally unsustainable.

2.1. Sustainable development of Bosnia and Herzegovina

The development of BiH in pre-war times can hardly be called sustainable. It was based on relatively large hydro and thermal energy potentials and large supplies of

coal and metal ores, which enabled BiH to produce more than half of the Yugoslav output in coal, 70% of the output in metal ores, iron, aluminium, led and zinc, and almost 50% of electric energy (BiH 2002). The intensive exploitation of natural resources using mainly outdated and highly polluting technology resulted in the degradation of the environment. Today's development also cannot be called sustainable. Post-war efforts focused on the reconstruction of the country and on the establishment of a new system of government. However, results were not desirable and the responsibility for BiH development is now shared between three administrative levels of the BiH state, two entities, and several cantons. Coordination, communication and information sharing, as well as the political will to make common decisions, are quite poor among the different levels of government and government officials. Despite an official commitment to harmonize its legislation to the EU Acquis, there are no comprehensive policies (e.g. environmental or energy policy). Therefore, the planning, development and monitoring of resource use, energy production, environmental protection, and social politics is slow, unreliable, and inefficient.

The proposed but never accepted Development Strategy of Bosnia and Herzegovina (BiH DEP 2010) identifies sustainable development as the fourth strategic goal (of six). Among the key factors that influence BiH's competitiveness, macro-stability and sustainable development, the strategy identifies climate change, the growing importance of renewable energies, and fluctuating prices of energy carriers. The strategy identifies three groups of priorities; one of them being ecology and energy potentials development. Under these, five more subset priorities have been identified. They are: using renewable and non-renewable natural resources; developing a concept of measurement for sustainability of development and the development of an environment infrastructure; ensuring stronger integration of environment protection with policies of other sectors; supporting development of the energy sector and supporting the development of all renewable sources of energy.

2.2. Development indicators of Bosnia and Herzegovina

All data demonstrate that the major obstacles to current BiH development are low income, a high trade deficit, and insufficient economic development. BiH has a population of approximately 3.8 million and a GNI per capita of 4,770 USD—almost two times lower than countries in Europe and Central Asia (avg. 7,272 US$)

and significantly lower than average in upper middle-income countries (5,884 US$). Manufacturing contributes only 11.26% to the GDP (BHAS 2011). Other indicators also paint a somber picture. UNDP's Human Development Report (2010) shows that 18% of the population is below the poverty line and a further 30% just above it. About 16.4% of employed people are poor (Brozek 2009). Sustainable development indicators emphasize this picture, as an illustration Environmental Performance Index (Yale 2010) report ranked BiH 98th on the list with a score of 55.9. Among the 43 European countries that were ranked, BiH is in last place and belongs to a group of countries that tend to feature rich natural resources with limited development. This indicator which incorporates resource consumption, depletion of environmental assets, pollution, etc. confirms that BiH is not performing well in these areas.

2.3. Sustainable energy indicators of Bosnia and Herzegovina

BiH is an energy intensive country. Energy transformation in BiH (particularly power generation) leads to high losses due to largely outdated or aging equipment and technologies (minimum 30 years old). In 2007, the final energy consumption per capita in BiH amounted to approximately 58 GJ (compared to the EU average 171 GJ) (AEA 2011). According to the World Bank (WB 2010) energy intensity of BiH is estimated at 0.77 toe of primary energy per 1,000 dollars of BDP. This means that BiH needs almost four times more energy than the average in EU to produce the same living. Yearly consumption of electrical energy per capita is 2,320 kWh (IEA 2008), and average in EU is about 6,145 kWh per capita. Yet, again, this difference emphasizes lower living standards and a low level of economic activity. The average final energy consumption per household shows similar results. The estimates are that at least 30% of energy is lost due to poor insulation of private homes. More than 60% of the population uses wood as fuel for heating. But an average households heats, during the winter, only 10 sq. meters of space, which is four times less than a household in the EU with the same quantity of energy. This fact indicates the high relative price of energy paid by households in Bosnia and Herzegovina (IEA 2008).

3. ENERGY DEVELOPMENT PATH-DİSCUSSİON

The sustainable energy policy of a country needs to provide direction on several crucial questions: how to reduce the environmental costs of energy production and use; how to satisfy increased requirements for energy services; and how to improve energy security. Subsequently, strategy needs to include measures to reduce energy demand, to develop renewable energy, and to increase the efficiency of existing energy sources. This paper tries to review just a couple of these aspects as related to BiH.

Strategy: BiH has no state energy policy or strategy. The Energy Sector Study of BiH (HP 2008) was supposed to be a basis for an Energy Strategy of BiH; instead, entities have adopted their own strategies. In 2009, the Federation adopted a Strategic Plan and Program of the Energy Sector of the Federation BiH up to year 2020. An energy Strategy for Republika Srpska, up to year 2030, was adopted in 2011.

Environmental costs of energy production: The dominant source of energy in BiH is fossil fuel - coal constitutes 63.2% and oil 21.9% of the primary energy supply (AEA 2011). According to the current plans of public companies, these sources of energy and how they are distributed will continue in the future. Reliance on fossil fuels means increased CO_2 emissions. BiH accounts for just a fraction of global emissions at 5.2 tCO_2/cap in 2010 (IEA 2012), but the highest share in GHG emission in the country comes from the energy sector, accounting for 92% of the total (HP 2008). Unfortunately, coal from Bosnia and Herzegovina has a three to four times lower energy value than coal used in the EU for electricity generation. As a result, carbon intensity per GDP, 1.58 ($kgCO_2$/GDP) for BiH, is several times more than in the EU (0.25) and shows that the production of electricity in Bosnia and Herzegovina results in much higher pollution.

Satisfaction of increased requirements for energy services: Electricity consumption is increasing and has reached 1990 levels, but the difference is that today's major consumers are households. Estimated consumption growth for the period 2013-2022 is about 3.5%. The power sector is divided between 44% from hydro sources and 56% from thermal power plants, but the majority of electricity comes from thermal plants: 68.7% in 2011 and 31.3% from hydro sources (NOS BiH 2012). It

is important to note that electricity production is highly dependent on hydrology. The production from hydro plants in 2011 represents only 55% of electricity produced in 2010. The low production rate had a negative impact on the total production which was 12% lower and on export, which constituted just 8.4 % of the total production and was lower by 61% than in 2010. This is something which needs to be taken into account when designing future energy systems. Not a single important energy facility has been built in the last 30 years and not a single facility construction started. Only the Stanari thermal power plant (300 MW), financed by a foreign investor who owns the coal mine, has a chance to become operational by 2016. The balance of power and energy for the next 10 years suggest that it is necessary to start as soon as possible with the realization of the planned dynamics of building new generating capacity, otherwise BiH may be faced with electricity imports (NOS BiH 2012).

To develop renewable energy sources (RES): By all estimates, the renewable energy potential of water, biomass and solar is strong. For example, according to the analysis of water catchments (Sarac 2011) a total estimated hydro-energetic potential of BiH is 6,126 MW. This potential, places the country as eighth in Europe (behind Norway, France, Italy, etc.). Regarding the usage of hydro potential (which is 39%), our country is definitely in last place in Europe (France 96%, Switzerland 91%, Germany 85%). The interest of investors to use this potential appears strong, but their plans appear highly unrealistic. Despite a number of concession rights granted to investors, at the moment only some 30 small hydro power plants are operational. The main reasons for this are too easily granted concessions or inadequate investors, the high costs of these technologies, but also a lack of or inadequate support for development of this potential. There is no state level action plan/goal for production from RES (RS will support production from RES up to 230.80 MW by 2020 and FBiH will support 19.8 MW in 2012). The amount for this support in FBiH is only 13.26 million BAM (KM) (FMERI 2012). On the other side, UNDP (2011) estimates that in BiH the subsidies on fossil fuels amount to 9-10% of GDP in the form of delayed environmental, maintenance and replacement costs, tax exemptions, etc. Significant risks that could affect the future development of hydropower include public opposition on the basis of environmental and social impacts, large costs for research and design, and a large initial construction cost. For small hydro, the major risk—in addition to local environmental opposition—is that, without streamlined approval and acceptance, small hydro may become unviable in many areas.

Pricing: Despite the relative high price of energy paid by consumers, the electricity prices in BiH are the lowest in Europe, and gas prices are among the highest in Europe (EUROSTAT 2011). According to the World Bank (2012), applied electricity tariffs did not fully cover depreciation costs of public electricity companies, are inadequate to sustain the needed investments, and put a strain on meeting their debt servicing requirements. Similarly, the coal production prices are higher than world norms and coal is sold to electric power companies below production costs, as coal mines indirectly subsidize electricity generation. These prices do not offer incentives for new investments or for energy efficiency.

To improve energy security: The security of energy supplies is undermined by delays in investments and technological progress. Plans for the construction of new facilities by public utilities and private investors are ambitious but obviously unrealistic and dynamics highly questionable, as the level of technical documentation is low in most cases (NOS BiH 2012). The Indicative Development Plan states that the register of new capacities, apart from thermal plants, includes 46 hydro power plants (2,221 MW) and 48 wind power plants (2,804 MW), etc. BiH alone has no financial and other capabilities to build even a single significant energy plant. Energy, in particular an electro system, is the most expensive system and requires huge capital investments. Only foreign investors or government can bear such huge investments. These investments require specific investment policies and financial models. According to available documents and plans, most new facilities are planned for export and should be built in the form of private-public partnership projects. But these projects are competing for investments with other power projects in the region or elsewhere. Investors will look at the demand for electricity in the region, expected market prices, state of the distribution network, and so on, but also at trends in EU regulations concerning CO_2 emissions.

Energy efficiency: Activities and investments into energy efficiency are almost non-existent, despite obvious significant potential for energy efficiency improvement and energy-saving measures such as insulation, double glazing, central heating, etc. For example, the estimate is that in Republika Srpska alone 80% of households have insufficient or inadequate insulation (MIERS 2012). The public discussion and activities of relevant stakeholders is focused much more on costly investments into new power facilities than in energy efficiency. BiH is the only country in the Western Balkan region that has not yet established energy efficiency policies and institutions (WB 2010). The energy efficiency laws of both entities have been

recently drafted, but strategy, a National Energy Efficiency Action Plan, and the targets are still missing. One of the rare EU Directives which has been implemented in BiH is the Directive on Energy Efficiency Characteristics of Buildings.

Human capital: The lack of knowledge and skills in all phases of the process of commissioning a plant is an extremely important issue which is often neglected in public discussions. As BiH has not built a single significant thermal or hydro power plant over the last 30 years, the only way BiH can implement the best available techniques is by engaging leading world contractors with experience and the needed knowledge.

4. CONCLUSION

The current energy development path is not sustainable. Sustainability does not only denote use of renewable energy sources, but efficient use of energy in the entire energy system. Heavy reliance on low quality coal, poorly maintained district heating systems, and low electricity tariffs encourage inefficient use of energy. The situation is further burdened with delayed and overall low shares of investment into energy, energy efficiency and renewables. Thus, the key to BiH's energy future is effective policy that integrates and uses the potential for renewable energy and energy efficiency, and strengthens local capacities for energy production, taking into account the climate, geographic and technological conditions. With the exception of hydro power, renewable energy sources are largely undeveloped. Fossil fuels will dominate the energy scene for many years ahead and RES replacement sources, in particular if policies are not changed, can supply only a fraction of current usage. In addition, it is expected that most renewable development schemes will be affected by environmental concerns. If renewables potential is developed in a timely manner, and considers economic factors, the interest of local communities, as well as trends in environmental regulations, it can have significant positive impacts on the economic balance of the country. However, if the current situation persists, Bosnia and Herzegovina will be forced to import electricity in the near future to meet its energy needs. BiH's future energy security is highly dependent on the investment model that it adopts for new energy plants.

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Wind and Solar Energy Potential Assessment in B&H Based on Real Measurements and Studies

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Abstract: The current generation capacity structure of the Public Power Company Elektroprivreda B&H (EP B&H) of 70%:30% in favour of TPPs provides some advantages like safe and reliable supply, but promoting RES and their use in the generation portfolio of the company is a commitment in order to contribute to sustainable development plans and environmental preservation. The ongoing measurement campaign performed by EP B&H investigates wind and solar energy potential on the territory of B&H. This creates preconditions for techno-economic evaluations of exploiting wind and solar power, with the final aim of building wind power plants (WPP) and photovoltaic power plants (PVPP) in the country. Particularly in terms of wind power, high altitude abandoned areas are assessed for potential WPP construction. Experience from the three year measurement campaign has shown promissing results in the available wind and solar potential of B&H, providing good preconditions for future techno-economic assessments and planning activities.

Keywords: wind potential, solar potential, harsh weather conditions

1. INTRODUCTION

Development, promotion and integration of renewable energy sources (RES) is being intensified lately. Use of RES is one of the strategic objectives of the European Union energy policy, expressed through the European energy legislation. Two important factors related to their implementation are:

- reduction of greenhouse gases, particularly CO_2 emissions and other negative environmental impacts
- decrease of dependence on fossil fuel and electricity import.

Nowadays, significant attention is given to the use of wind and solar energy.
On the territory of Bosnia and Herzegovina (B&H) three power companies are active in the field of power generation, distribution and supply of electricity. Among them, both, by the total installed capacity in power generating facilities, as well as electricity production, the Public Power Company Elektroprivreda of Bosnia and Herzegovina (EP B&H) is the largest (NOS, 2012). Total electricity generation is based on domestic coal fired thermal power plants

(TPP) and hydro power plants (HPP), with a minimal participation from small HPP (sHPP), approximately 1%. The current generation capacity structure of 70%:30% in favour of TPPs provides some advantages like safe and reliable supply, but promoting RES and their use in the generation portfolio is a commitment in order to contribute to sustainable development plans and environmental preservation.

2. MATERIALS AND METHODS

2.1. Measurement Campaign

The ongoing measurement campaign performed by EP B&H investigates wind and solar energy potential on the territory of B&H. This creates preconditions for techno-economic evaluations of exploiting wind and solar power, with the final aim of building wind power plants (WPP) and photovoltaic power plants (PVPP) in the country.

2.2. Wind Energy Potential Database

Currently, there are ten wind data acquisition and monitoring systems in operation, seven of which are mounted on tubular (T) and the remaining three on lattice masts (L). These measurement systems are compliant with the IEC 61400-12-1 Standard (IEC, 2005) and MEASNET recommendations (MEASNET, 2009) and equipped with first class equippment, i.e. anemometers, wind vanes, as well as air pressure, humidity and temperature sensors.

In this paper, the focus is set on wind data acquisition and monitoring systems located in mountainous terrains characterized by high altitudes, complex terrain surface, cold and long winters, low temperatures, strong wind gusts, snow drifts and icy sediments. This includes research and evaluation of specific wind characteristics recorded at altitudes ranging from 970 m to 1800 m a.s.l. and identifying operating constraints in harsh weather conditions. In addition to wind energy potential assessment, the goal as well is to consider and examine possibilities of exploitating otherwise unused high altitude mountain areas in order to construct WPPs. Analyses summerized in this work are performed at the six best locations, selected based on previous assessments. Basic information of considered locations together with their installed measurement systems are given in Table 1, and their positions are shown in Figure 1.

Table 1. Measurement systems – basic information

Location	Altitude [m]	Area [km^2]	Mast type (T /L)	Mast height [m]	Measurement start	Analysed measurement period
Bitovnja	**1656**	4,1 x 0,8	T/ L	30/ 60	29.07.2010. (T) 21.09.2012. (L)	01.08.10. - 31.07.11
Borisavac	**1171**	4,1 x 1,5	T	60	16.07.2010.	01.08.10. - 31.07.11.
Medvedjak	**970**	2,8 x 0,9	T	30 (60)	07.11.2010. (60) 25.02.2011. (30)	07.11.10. - 28.01.11. 01.03.11. - 30.11.11.
Rostovo	**1318**	1,2 x 0,1	T	60	24.07.2010.	01.08.10. - 28.01.11. 01.05.11. - 31.10.11.
Vlasic	**1707**	0,4 x 0,7 1,4 x 0,7	T/ L	30/ 60	19.11.2010. (T) 12.09.2012. (L)	01.12.11. - 31.11.12. 12.09.12. - 11.01.13.
Z. Kosa	**1274**	0,8 x 0,3	T	30	03.04.2010.	01.05.10. - 30.04.11.

2.3. Solar Energy Potential Database

Solar irradiation measurements are performed at ten selected locations, starting from May 2010. Those locations are spatially distributed in order to be able to estimate the relevant information and solar energy potential for the widest possible area of B&H (Fig. 1). At this point, the main objective is to assess the solar energy potential, whereby the techno-economic viability of electricity generation from PVPPs will be evaluated in further steps.

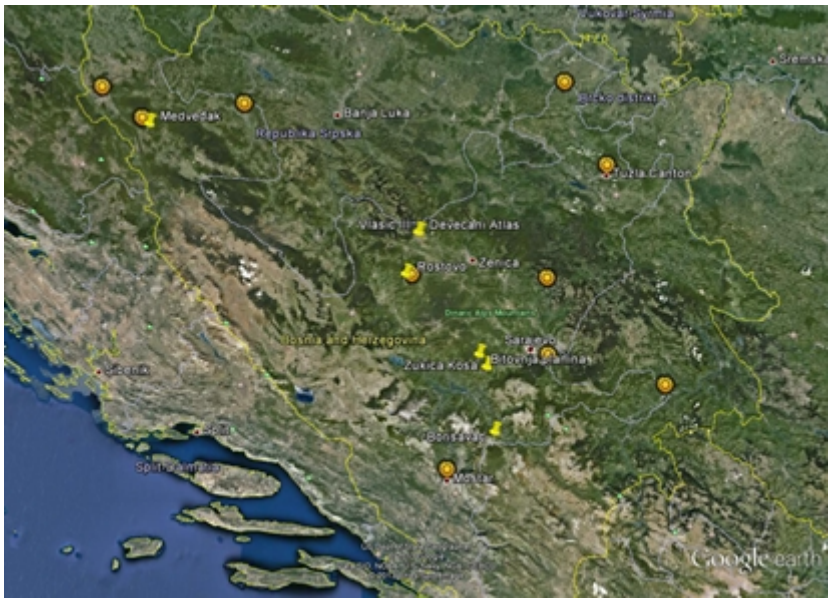

Figure 1. Layout of the solar potential measurement stations wind data acquisition and monitoring systems

3. RESULTS AND DISCUSSION

3.1. Wind Energy Potential Data Evaluation and Discussion

Analyses of recorded data have been performed in order to gain information on wind energy potential in B&H. Taking into account regulations in the field of wind energy utilisation; in most cases data measured during a period of one year has been analyzed. Available space was considered, based on which the number of wind turbines has been determined. Infrastructure requirements at the site have been assessed, and technical losses have been taken into account for WPP net energy yield

calculations. Energy yield calculations have been performed for the wind turbine type Siemens SWT-3.0 -101, IEC Class IA, which meets the toughest conditions at the site, when it comes to extreme wind potential values and turbulence. Evaluations have been made using the professional software tool WindPRO, based on filtered data, except for site Vlasic. In this sense, recorded values which are the results of frequent icing and difficulties in anemometer measuring, due to snow and icing during winter months, have been considered in this paper. Statistical analyses, energy yield calculations and WPP layout opimization have been taken over from materials prepared by (Energiewerkstatt, 2012) in related consulting services, apart for the site Vlasic where evaluations and assessments have been taken out independently, as well as from (A.Lukac et.al., 2011; 2010). Results on wind energy potential at the selected sites are presented in Table 2.

Table 2. Results on wind energy potential and infrastructure requirements

Location	Average recorded wind speed (30m) [m/s]	Average recorded/calculated wind speed (60m) [m/s]	Wind power density (30 m) [W/m^2]	Max. wind speed [m/s]	Installed capacity [MW]	Net energy yield P(50) – Siemens SWT 3.0-101 [MWh/turbine]
Bitovnja	6,99	7,29	328	24,6	54	8667
Borisavac	5,17	5,81	158	26,7	48	5928
Medvedjak	5,11	5,45[3]	189[4]	24,2	33	6759
Rostovo	4,92	5,40	132	26,5	18	5827
Vlasic	5,32	6,35	240	24,0	51	6220
Z. Kosa	5,20	5,78[3]	143	19,9	36	7438

Location	Infrastructure requirements	Capacity factor [%]	Specific investment [€/kW]	Data availability [%]	Overall ranking
Bitovnja	Roads: approx. 11 km HV transm.: approx. 10 km	33,0	1362	87	1
Borisavac	Roads: approx. 11 km HV transm.: -	22,5	1336	96	4
Medvedjak	Roads: approx. 3 km HV transm.: approx. 5 km	25,7	1356	91	2
Rostovo	Roads: approx. 2 km HV transm.: -	22,1	1334	96	5
Vlasic	Roads: approx. 4 km HV transm.: approx. 4 km	23,7	1335	86	3
Z. Kosa	Roads: approx. 5 km HV transm.: -	28,3	1345	98	1

It should be pointed out that during the data aquisition campaign notable effort has been put in place in order to secure reliable and undisturbed data collecting. However, inconsistencies in data acquisition, mainly due to harsh weather and icing, could unfortunately not be avoided. To have an idea of data availability, a separate column is included in Table 2. As for the main part icing periods have been experienced during the time where higher wind speeds can be expected (i.e. winter), it can be expected that the average recorded wind speeds should be at least the values given in Table 2.

A high capacity factor for most of the given sites indicates a high utilization potential, which is indicative of the power and wind propperties found at the selected locations. There is, however, the problem of insufficent infrastructural development at some of the reference sites, which could pose challenges in the phase of project implementation. Nevertheless, to account for these adjustments, a quantification in form of a specific investment calculated as total estimated capital investment to total installed capacity has been given. From these estimates it is to be concluded that insufficiency in infrastructural development could partially be complemented by the VPP layout and sizing which is why ultimately all of the six selected sites fall more or less within the same price range. It should also be pointed out that these values represent estimates, based on expected project requirements and data collected on estimated investments for one of the sites based on data provided by (Energiewerkstatt, 2012). These investments have then been scaled to the equivalent project size and used as a basis for further calculations at the remaining five locations. The investment has hereby been split and assessed to the following five cathegories: turbine costs and construction works, grid connection, construction works for HV transmission lines, construction works for access roads, and remaining costs. In the case of a positive decision for a further investigation on a project viability assessment, a detailed techno-economic analysis should be performed. Also, other turbine manufacturers should be considered, due to different output characteristics. Particular care should thereby be taken of the turbine class, to meet expected working conditions at the given site.

The overall ranking factor k_i has been determined based on the highest reference value of the capacity factor and lowest estimated specific investment, as the maximum value of (1)

$$k_i = \frac{CF_i}{CF_{max}} \cdot \frac{SI_i}{SI_{min}} \quad (1)$$

where: CF_i – is the capacity factor of site *i*, CF_{max} – is the maximum capacity factor of all considered sites, SI_i – is the specific investment for site *i*, SI_{min} – is the minimum specific investment of all considered sites and *i* is the number of sites considered.

3.2. Solar Energy Potential Data Evaluation and Discussion

Using recorded data on global solar irradiation, average insolation has been calculated for all of the ten locations. Values have been taken over from (A.Lukac et.al., 2011) and materials prepared by (Energiewerkstatt, 2012) in related consulting services, apart for the sites Medvedjak and Rostovo, where evaluations and assessments have been taken out independently. Results are presented in Table 3. Although other data on solar irradiation available for B&H can be found as well in (METEOTEST, 2007; European Communities - PVGIS, 2012; Les Presses de l'Ecole - ESRA, 2000); values stated in Table 3 can be considered reliable and relevant for the analysed locations. The amounts given in Table 3 indicate that B&H has a significant solar energy potential. Comparing these values with data for Central and Northern Europe, it can be concluded that B&H disposes of 15% and 30% more potential, respectively (METEOTEST, 2007). Still, there is only a neglible number of PVPPs (with installed capacity of only a few tens of kWs) in operation in B&H. High prices, poor promotion and lack of the legal framework and financial support system, have for a long period of time been the main cause of insufficient resource utilization. Increased interest in RES utilization in B&H, especially in the field of solar energy, has significantly been stimulated recently by the introduction of the FiT system and the relevant legal framework establishment. This was followed by a large number of registered projects for PVPP construction.

Table 3. Average insolation

Location	Analysed period	Insolation [kWh/m^2]
Bihać	Nov. 2010 - Oct. 2011	1233
Budoželje	Jul. 2010 - Jun. 2011	1367
Donji Lukavac	May 2010 - Jan. 2011	1208
Goražde	Oct. 2010 - Sep. 2011	1216
Medvedjak	Nov. 2010 – Mar. 2012	1710
Mostar	Nov. 2010 - Oct. 2011	1560
Rostovo	Jul. 2010 – Apr. 2012	1455
Sanski Most	Nov. 2010 - Oct. 2011	1293
Sarajevo	Nov. 2010 - Oct. 2011	1286
Tuzla	Nov. 2010 - Oct. 2011	1330

For the main part, data assessed in this analysis contains one year records, which enables data evaluation on a yearly basis, with regard to seasonal variations. According to the available solar irradiation databases (METEOTEST, 2007; European Communities - PVGIS, 2012; Les Presses de l'Ecole - ESRA, 2000) as well as (Energy Institute Hrvoje Požar et al, 2007; FMEMI, 2009) the highest solar potential of B&H lies in the coastal regions (see Fig. 1 and Table 3), however, some of the inland locations should not be disregarded as well. According to the analysed results, the best insolation value, unexpectedly, was found at site Medvedjak, located in the north – west part of the country. The reason is relatively high altitude of the measurement site, with high winds and very few foggy days.

Particular interest should be given to optimization of the PV generator (panel tilt angle, orientation and position) thereby considering local weather conditions (such as high wind, high temperatures on some locations or ice and snow sediments at some high altitude sites). As previously mentioned, this assessment is focused on solar potential evaluation only.

Relying on recorded data and performed calculations and taking into account the existing infrastructure at the site, EP B&H has chosen one of the favourable locations for a pilot project implementation. On top of the roofs of two buildings of the Central Warehouse ED Mostar, an approximated 40 kW grid connected PV system will be installed. This system will be optimized considering the number of

PV modules, their orientation and tilt angle as well as the number and type of inverters and all other necessary equipment. Main expected outcomes of implementing this trial project are the gaining of required experience and knowledge with the aim of applying this knowledge to plan the construction of further PVPPs with significant installed capacity. The pilot project implementation will provide possibilities in analysing effects of the PVPP connection to the LV distribution network, as well as the assessment of the necessity for the innovation of the Technical Reference for Distributed Generators Connection and Operation.

4. CONCLUSION

EP B&H has demonstrated will to promote RES and their use in the generation portfolio of the company as a commitment to contribute to sustainable development plans and environmental preservation. The ongoing measurement campaign performed by EP B&H, investigating wind and solar energy potential on the territory of B&H has shown promissing results in the available resource potential for B&H, whereby the implementation of listed WPP would avoid cca 477,000 t CO_2 per annum.

Considering the fact that the measurement campaign focused on researching wind potential at relatively high altitudes, inconsistencies in data aquisition could not be avoided due to harsh weather and icing. Such conditions caused mast break down at two sites and often icing of moving parts of the measuring equipment, which decreased data availability during winter months, resulting in lower values of wind potential indicators. In that sense, wind potential indicators at the sites are surely higher than values presented in this paper. Also, it can be concluded that significant wind potential at otherwise unused high altitude mountain areas will exceed insufficiently developed infrastructure at sites, when it comes to project realization phase.

In terms of solar potential, B&H disposes with 15% and 30% more potential than Central and Northern Europe, respectively, according to the results presented in this paper. According to available references so far, south regions have been considered as regions with the highest values of insolation. However, analysed measurement results, presented in this paper accentuate an inland location. It can be concluded that each project requires a serious approach, primarly, proper evaluation

of solar potential data, using first-class measuring equipment in accordance to applicable standards.

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A practical way to analyze Wind Turbine data: Wind Power Data Reader

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Abstract: To meet the growing demand, new ways are being seeked to find new alternative sources. But, finding an alternate source is not enough, due to the fact that the power source should be sustainable and feasible. To be able decide whether it is efficient or not, we need to be able to analyze production rate. That is why data monitoring is an important area for energy production. We are able to gather raw data from power generator infrastructures. But these data is only raw data. We need a visual and interpretable ways to analyze, to utilize and to predict the efficiency of production. This paper focused on data monitoring part of energy production which output by wind turbines. The main purpose of this work is to provide to convert raw data into more readable and more analyzable format. We have prepared Wind Data Analyzer to visualize data by using elasticity of OOP (object oriented programing) to wind turbine data.

Keywords: smart grid, renewable energy, data analyzer

1. INTRODUCTION

The need to renew electricity networks is based on the growing electricity demand, the establishment of the electricity markets and the integration of more sustainable generation resources including renewable ones. This need forced scientists to build a new and efficient control mechanism for power grids named Smart Grid.
Smart grid, a mechanism to provide bidirectional communication and control between electricity providers and consumers, is the subject of great public interest as

a means to enable a more efficient and renewably powered electricity grid infrastructure (J. April 2010).

Having more information and control provides powerful capabilities; like providing more precise system design and performance, more reliability, capability to meet costumer need, more products and services, reduced environmental impact (Figure 1).

The existing technologies are combined with innovative solutions by Smart Grids network. Not only future grids build on existing one but also are led new system concepts to be implemented like " Wide area monitoring and protection ", "micro grids" and "Virtual power generation". Centralized generation will stay as an important part of generation. But, many more actors will be involved in the generation, transmission, distribution and operation of the system including end customer. Based on these assumptions, we need to have rapidly deployable and cost effective technical solutions to enable existing grid to accept power inputs from other power sources without excessing critical operation limit. There must be standards for equipment and protocols, so that different manufacturers' equipment will fit together or one manufacturer's equipment will be switchable with another's one, and there must be a backward compatibility. Beside these, we need to develop systems of information, telecommunication and computing which enable utilization of innovative service arrangement to improve their efficiency(Buchholz 2006). Smart Grid network consist of following components; broadband over power lines, monitors and smart relays at substations, monitors at transformer circuit breakers and reclosers and bi-directional meters with two way communications.

As new alternative power sources are found, new supplies will be added to the grid systems. But, problem with alternative power sources is intermittent behavior (Yang Peihong 2012). It is not easy to integrate such power source to traditional power grid. With changing conditions, production rate changes. So it is necessary to utilize the energy before use or to transmit to power grid system(Ahmed Mohamed 2012). Wind power cannot be used as seldom power source. It must be backed up with other power sources such as hydroelectric and coal plants(Lovins 2011). This is also force us to utilize production and the backup system. To achieve a good utilization we have to interpret data carefully, otherwise it may jeopardize grid system or turbine safety. Taking the data which is gathered from wind turbines into account, it is really not easy to interpret data with thousands of lines as it is shown

in Table 1. So it is necessary to visualize the available data. This will help us to interpret and predict how the power production will occur in a certain time range. This paper is focused on monitoring and analyzing data obtained from wind turbines. Functionalities and codes of Wind Data analyzer software will be explained in the paper.

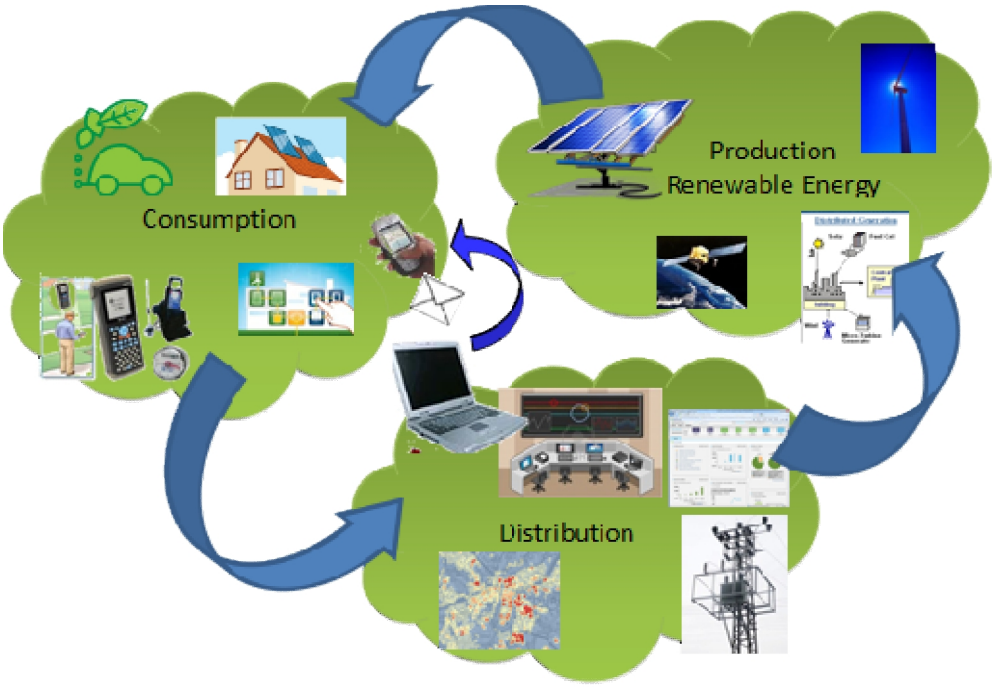

Figure 1. Representation of Smart grid model

Table 1. Wind turbine sample data provided by http://data.aprsworld.com/

Time	AC Voltage	DC Current	DC Voltage	AC Frequency	Output	Energy Production
00:00:03	381	214	16	92	60	1402
00:00:13	374	214	14	83	60	1092
00:00:23	386	213	20	102	60	1908
00:00:33	423	216	48	156	60	7449
00:00:43	406	216	36	133	60	5105
00:00:53	415	216	41	143	60	6020
00:01:02	389	215	22	104	60	2434
00:01:12	397	215	26	117	60	2876
00:01:22	396	215	25	116	60	2736
00:01:32	393	215	24	112	60	2765
00:01:42	384	215	20	97	60	1946

2. WİND POWER DATA ANALYZER

Wind Power data analyzer software is designed to analyze and visualize data which provided by **http://data.aprsworld.com/** on daily bases. We are able to get lots of raw data from wind turbines. But, this data is only numbers or logs about current state of turbines. To say how efficiently this turbine functioning, we need to convert this data more readable format. So that was the reason that forced us to design wind data Analyzer. This graphical representation of raw data enables us to make more accurate prediction about performance and efficiency of wind power production. Some unique features are explained below.

- Interface design of wind data analyzer has a simple and all-in-one place design helps us to see everything in one place, but, tabbed design prevents confusion.
- Instead of using third party libraries, Wind data analyzer design with standard libraries. This fact helps us to save some budget and also mitigate portability issues(Jonge 2009).

- With wind data analyzer, you can limit time range, so that summary will be shown for that range only. Beside this, zooming for selected area is available, this is to enable user to be able to examine a time range more closely.
- You can get online data by selecting date and time range, if you have internet connection.

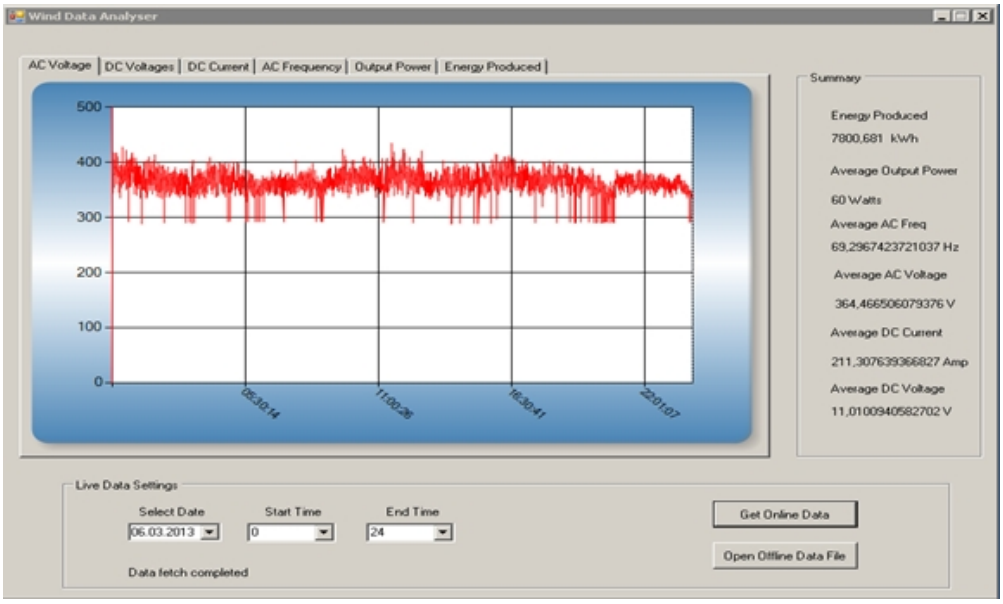

Figure 2. A sample view form wind data analyzer software

3. BACKGROUND OF WİND DATA ANALYZER: GATHERİNG DATA AND VİSUALİZİNG PROGRESS

Our software works with data provided by http://data.aprsworld.com/ , and main features of it expressed above. In this part, we will focus on coding part and mention important points. This software designed by using C# programming language with standard libraries. We can group the functionality of software in to two parts.

3.1 Gathering online and offline data

Fetching process can be handled in two ways; the first one is getting online data. The technique which we used to gather data is URL generation. We generate URL by providing date, beginning and ending hours (Code Fragment 1). Webclient

library set connection to open related website with providing generated URL. After connection set, we fetch data by using StreamReader library.

```
WebClient client = new WebClient();
client.Headers.Add("user-agent",  "Mozilla/4.0  (compatible;  MSIE  6.0;
Windows NT 5.2; .NET CLR 1.0.3705;)");
string  url  =  "http://data.aprsworld.com/data/ps2/rawData.php?station_id
=A2671&packet_date="   +datadate+"   00:00:00&hours_before="   +starthour
+"&hours_after="+stophour;
Stream data = client.OpenRead(url);
StreamReader reader = new StreamReader(data);
onlineData = reader.ReadToEnd();
```

Code Fragment 1. Gathering online data

For the offline data, we download the same data for a date or dates from website with links provided by the site. The read data in to the software with

```
if (openFileDialog1.ShowDialog() == DialogResult.OK)
            {   if (openFileDialog1.FileName != "")
                {  richTextBox1.LoadFile(openFileDialog1.FileName,
RichTextBoxStreamType.PlainText);
                    data.AddRange(richTextBox1.Lines);
                    data.RemoveAt(0);
```

Code Fragment 2. Opening an offline file

3.2 Visualizing process

After fetching data, each line of data passed to an instance of Variable object then to a generic list structure (Code fragment 3). Instead of using static Array structure, we preferred dynamic data structure. This saves us from making assumption about the array size of thousands of lines. By this way, we make data available for the entire codes in our program.

```
List<Variables> dList = new List<Variables>();
……..

foreach (string s in data)
{     string[] sLine = s.Split(',');
    if (sLine.Length > 7)
    {    variables var1 = new Variables();
        var1.BusVoltage = int.Parse(sLine[5]);
        var1.AcVoltage = int.Parse(sLine[7]);
        var1.DcCurrent = int.Parse(sLine[8]);
        var1.DcVoltage = int.Parse(sLine[9]);
            dList.Add(var1);
```

Code Fragment 3. Reading data into generic list structure

To visualize data, instead of using a third party tool, we used ms charting tool to provide more portability. Using third party tool sometimes causes incompability issues.

Our program keeps each part of data in a separate chart on tab control to able to see everything in one place.

```
{  chDC.Series.Add("DC Voltage");
            }
            chDC.Series["DC Voltage"].SetDefault(true);
            chDC.Series["DC Voltage"].Enabled = true;
            chDC.Series["DC Voltage"].ChartType =
SeriesChartType.FastLine;
            chDC.Series["DC Voltage"].Color = Color.Red;
            chDC.Visible = true;
            foreach (Variables v in dList)
            {
                chDC.Series["DC Voltage"].Points.AddXY(v.Saat,
v.DcVoltage);
            }
```

Code fragment 4. A sample code from charting tool

4. CONCLUSİON

This work showed us that converting raw data to an analyzable format is vital. Due to fact that wind power systems (and also other alternate sources) are not completely independent from other systems. It still relys on other annual wind regime, backing up systems, power grid system. These depencies forces us to make a good prediction, forecasting and installation planning. To be able to do all of these, we need more readable and analyzable data more than a data in raw format. As a next

step to our work, live data can be fetched and used for controlling wind turbines and the integration to smart grid systems.

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